UNEP DTU Partnership, World Resources Institute

Transformational Change Methodology

Assessing the transformational impacts of policies and actions[1]

June 2019

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PART I: INTRODUCTION, OBJECTIVES, DEFINITION AND STEPS

1. INTRODUCTION

The unprecedented challenge of climate change requires that society undergoes a fundamental change away from carbon-intensive and unsustainable models of development. It is crucial that climate and development policies avoid further investments in fossil fuel infrastructure and promote clean technologies to ensure alignment with the Paris Agreement's temperature goal and the 2030 Agenda for global sustainable development goals. In this context, there is an increasing need to assess the transformational impacts of policies and actions and understand, whether they can catalyze sustained shifts in economic, political, social and technical systems.

1.1 Purpose of the methodology

The purpose of this methodology is to help users assess transformational potential and impacts of policies and actions to reduce greenhouse gas (GHG) emissions. Transformational impacts can result from processes and outcomes of policies or actions that drive structural changes in society towards climate change mitigation and sustainable development goals and targets, such as those envisioned in the Paris Agreement, Nationally Determined Contributions (NDCs), long-term low-emission reduction strategies and the 2030 Agenda Sustainable Development Goals (SDGs). Transformational changes can occur at international, national and subnational levels. Drivers of transformational change include changes in technology, social norms, behaviour, and economic and non-economic incentives and disincentives. When a policy's change is transformational, its impacts can alter the structures of society to achieve climate and sustainable development outcomes that are large in scale and are sustained over time.

This methodology has been developed with the following objectives in mind:

- To help users assess the extent of transformation expected or achieved by policies or actions
- To help decision makers develop effective strategies for transformational change through better understanding of how policies or actions can set in motion processes that lead to transformational outcomes
- To support transparent and consistent monitoring and reporting of transformational impacts

Chapter 2 further explains the objectives that users may have for assessing the extent of transformation expected or achieved by policies or actions.

1.2 Intended users

The methodology is intended for a wide range of users, including governments, donor agencies and financial institutions, businesses, research institutions and non-governmental organizations (NGOs). Throughout the methodology, the term "user" refers to the person or entity applying the methodology.

The following examples show how different types of users can apply the methodology:

- Governments: Assess the expected impacts of policies or actions to inform the design of transformational policies, and monitor progress and evaluate impacts of implemented policies or actions to learn from experience.

- Donor agencies and financial institutions: Assess the impacts of financial support provided, such as grants or loans, to support transformational policies or actions.
- Businesses: Assess impacts of private sector actions such as voluntary commitments and implementation of new technologies, private sector financing, or the impacts of government policies or actions on businesses and the economy.
- Research institutions and NGOs: Assess the extent to which policies or actions are transformational to generate new information to increase stakeholder awareness and support decision makers.

1.3 Scope and applicability of the methodology

This methodology provides a general approach including principles, concepts and procedures that users can follow when assessing the transformational impacts of a planned policy or action. The document also contains hypothetical examples and case studies that illustrate how to apply the methodology in practice. It covers both ex-ante (forward-looking) assessment and ex-post (backward-looking) assessment.

The document is organized into five parts (Figure 1.1). Part I introduces the document and the concept of transformational change, including objectives, principles and an overview of steps. Part II provides steps to define the assessment. Part III discusses ex-ante and ex-post impact assessments. Part IV covers monitoring and reporting and Part V discusses the use of assessment results for decision making.

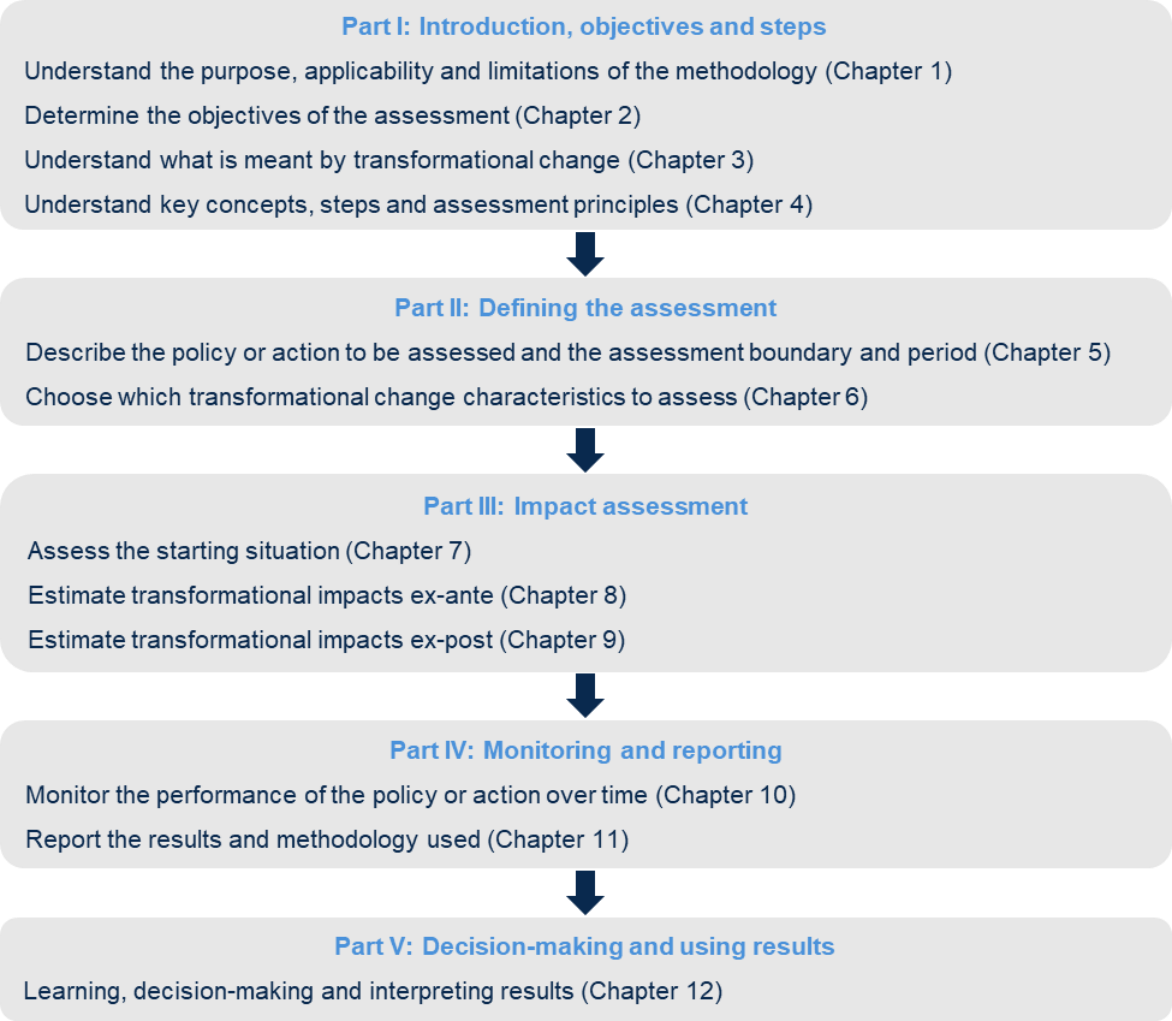
The methodology is concerned with transformational change for climate mitigation and sustainable development and is applicable to all types of policies or actions in all sectors[2]. It is limited in depth by not taking a sector-specific approach to assess transformational impacts. This means that characteristics of transformational change are developed as broad descriptions rather than specific to transformations in a given sector or subsector. A limitation of the generic approach is that it does not provide a comprehensive list of indicators for transformational change covering the specifics of all sectors. It also does not propose a full list of quantitative metrics. Appendix A provides examples of indicators of transformational change characteristics for users to develop more specific indicators for their policy or action.

The methodology is intended to be flexible and users should apply it considering their own objectives and circumstances. It provides recommended steps rather than requirements and is non-prescriptive to accommodate various national circumstances.

The methodology provides a qualitative approach to assess the extent of transformation expected or achieved by policies or action. It provides users with an option to quantitatively monitor indicators of transformational change as the basis for qualitative assessment. The approach enables assessment of the contribution to transformational impacts by a policy or action, not the attribution of impacts from a single intervention as cause-effect relations are not assessed and quantified.

[2] ICAT uses consistent terminology with the 2006 IPCC Guidelines for sectors: Energy; Industrial Processes and Product Use (IPPU); Agriculture, Forestry and Other Land Use (AFOLU); Waste; Other (e.g., indirect emissions from nitrogen deposition from non-agriculture sources). However, users can define boundaries for sub-sectors specific to the policy or action, as needed.

Figure 1.1: Overview of the methodology



Types of policies and actions

In this methodology, policies and actions refer to interventions taken or mandated by a government institution or other entity. Examples of policies or actions include laws, directives, decrees, regulations and standards, taxes, charges, subsidies and incentives, information instruments, voluntary agreements, introduction of new technologies, processes or practices, public or private sector financing and investments.

The terms “policy” and “action” refer to interventions at various levels along a continuum, from (1) broad strategies and plans that define high-level objectives or desired outcomes (such as 60% solar power in the grid by 2050); to (2) specific policy instruments to carry out a broad strategy or plan (such as a feed-in tariff for solar PV systems); to (3) the implementation of technologies, processes or practices that result from policy instruments (such as mandating PV systems on rooftops of government buildings). These are illustrated in Figure 1.2, which shows the range of interventions from more aspirational to more concrete.

Figure 1.2: Types of interventions along a policy continuum

Type of intervention	Example	Applicability of methodology
Broad strategies, plans or goals	Intent to increase energy efficiency by 30% by 2030	Not applicable; should further define the specific policy instruments to achieve the broad strategy
Policy instruments	Energy efficiency standard for appliances	Applicable
Implementation of technologies, processes or practices	Replacement of old appliances with new efficient ones	Applicable

This methodology is primarily designed to assess policy instruments and the implementation of technologies and processes that might influence or shape meaningful practices. Users that intend to assess the impacts of broad strategies or plans should first define the policy instruments or technologies, processes or practices that will be implemented to achieve the strategy or plan. Broad strategies or plans can be difficult to assess since the level of detail needed to assess impacts may not be available without further specificity, and different policies or actions used to achieve the same goal could have different impacts. Further, it is designed for actions at a higher level than individual projects, though users assessing the impacts of individual projects or programs may also find this methodology helpful.

The methodology is applicable to policies and actions:

- At any level of government (national, subnational, municipal) in all countries and regions
- In any sector (such as transport, energy, agriculture, forestry, industry and waste) as well as cross-sector policy instruments
- That are planned, adopted or implemented
- That are new policies or actions, or extensions, modifications or eliminations of existing policies or actions

Table 1.1 presents general types of policies or actions that may be assessed. The list is not exhaustive, and some users may have policies and actions of other types.

Table 1.1: Types of policies or actions

Type of policy or action	Description
Regulations and standards	Regulations or standards that specify abatement technologies (technology standard) or minimum requirements for energy consumption, pollution output, or other activities (performance standard). They typically include penalties for noncompliance.
Taxes and charges	A levy imposed on each unit of activity by a source, such as a fuel tax, carbon tax, traffic congestion charge, or import or export tax.
Subsidies and incentives	Direct payments, tax reductions, price supports or the equivalent thereof from a government to an entity for implementing a practice or performing a specified action.
Voluntary agreements or measures	Agreements, commitments or measures undertaken voluntarily by public or private sector actors, either unilaterally or jointly in a negotiated agreement. Some voluntary agreements include rewards or penalties associated with participating in the agreement or achieving the commitments.
Information instruments	Requirements for public disclosure of information. These include labeling programs, emissions reporting programs, rating and certification systems, benchmarking, and information or education campaigns aimed at changing behaviour by increasing awareness.
Emissions trading programs	Programs that establish a limit on aggregate emissions of various pollutants from specified sources, requires sources to hold permits, allowances, or other units equal to their actual emissions, and allows permits to be traded among sources. These programs can be referred to as emissions trading systems (ETS) or cap-and-trade programs.
Research, development, and deployment (RD&D) policies	Policies aimed at supporting technological advancement, through direct government funding or investment, or facilitation of investment, in technology research, development, demonstration, and deployment activities.
Public procurement policies	Policies requiring that specific attributes (such as GHG emissions) are considered as part of public procurement processes.
Infrastructure programs	Provision of (or granting a government permit for) infrastructure, such as roads, water, urban services, and high-speed rail.
Implementation of new technologies, processes, or practices	Implementation of new technologies, processes, or practices at a broad scale (for example, those that reduce emissions compared to existing technologies, processes, or practices).
Financing and investment	Public or private sector grants or loans (for example, those supporting development strategies or policies such as development policy loans (DPL) or development policy operations (DPO) which includes loans, credits and grants or private sector development grants in high-risk or small markets.

Source: WRI 2014; based on IPCC 2007.

1.4 When to use the methodology

The methodology can be used at multiple points in time in the policy design and implementation process, including:

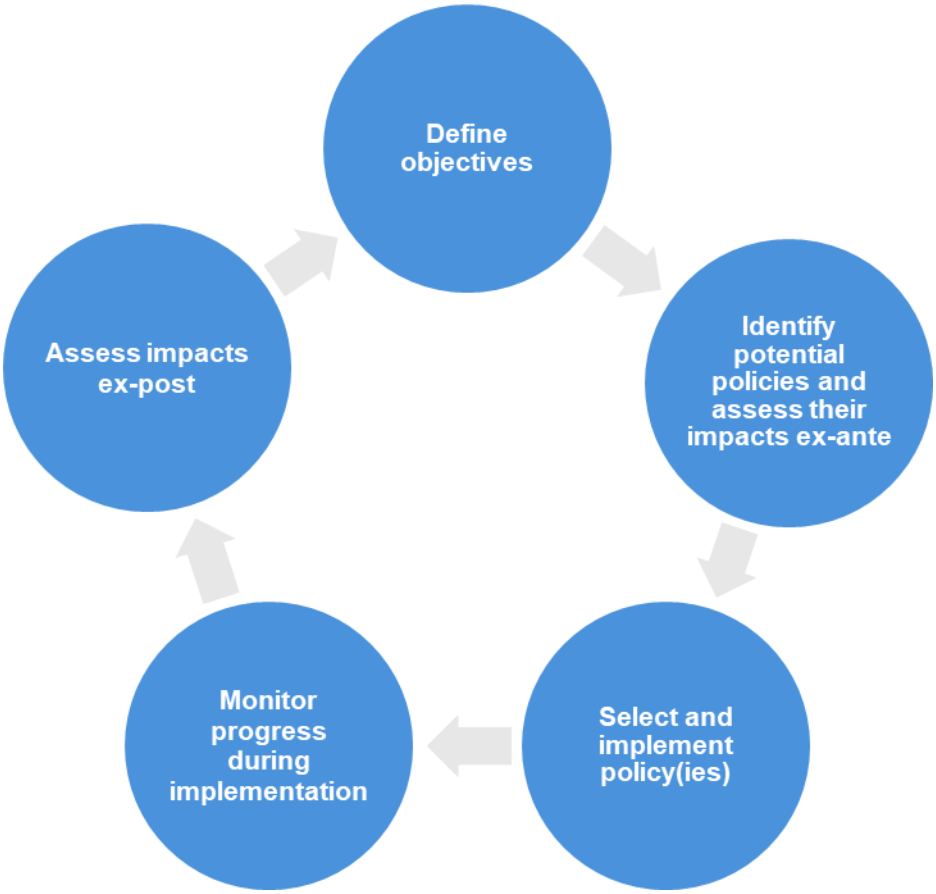
- **Before policy implementation:** To assess the extent of transformation expected from a policy or action (through ex-ante assessment)
- **During policy implementation:** To assess the extent of transformation achieved to date, ongoing performance and the extent of transformation expected in the future from a policy or action
- **After policy implementation:** To assess the extent of transformation achieved as a result of a policy or action (through ex-post assessment)

Depending on individual objectives and when the methodology is applied, users can implement the steps related to ex-ante assessment, ex-post assessment or both. The most comprehensive approach is to apply the methodology first before implementation, regularly during policy implementation, and again after implementation. Users carrying out an ex-post assessment only can skip Chapter 9. Users carrying out an ex-ante assessment only can skip Chapter 10 and 11.

Figure 1.3 outlines a simplified sequence of steps to monitor and assess impacts at multiple stages in a policy[3] design and implementation cycle. In the figure, the process is iterative such that insights from previous experience inform improvements to policy design and implementation and the development of new policies.

[3] Throughout this methodology, where the word “policy” is used without “action,” it is used as shorthand to refer to both policies and actions.

Figure 1.3: Assessing impacts during a policy design and implementation cycle



1.5 Key recommendations

The methodology includes *key recommendations* that represent recommended steps to follow when assessing and reporting the extent of transformation expected or achieved. These recommendations are intended to assist users in producing impact assessments that are of high quality and based on the principles of relevance, completeness, consistency, transparency, accuracy and reflection on ambition.

Key recommendations are indicated in subsequent chapters by the phrase "It is a *key recommendation* to…." All key recommendations are also compiled in a checklist at the beginning of each chapter.

Users that want to follow a more flexible approach can choose to use the methodology without adhering to the key recommendations. The ICAT *Introductory Guide* provides further description of how and why key recommendations are used within the ICAT methodology documents, as well as more information about following either the "flexible approach" or the "key recommendations" approach when using the methodology. Refer to the *Introductory Guide* before deciding on which approach to follow.

1.6 Relationship to other ICAT methodologies

This methodology is part of the ICAT series of methodologies for assessing impacts of policies and actions, available at https://climateactiontransparency.org/icat-guidance. It is intended to be used in combination with any other ICAT guidance documents that the user chooses to apply, including:

- Sector-level methodologies for assessing greenhouse gas impacts of policies or actions in the agriculture, forestry, energy and transport sectors
- Sustainable development methodology on how to assess the environmental, social and economic impacts of policies or action
- Stakeholder participation guide on how to carry out effective stakeholder participation when designing, implementing and assessing policies and actions, including when assessing transformational impacts using this guide
- Technical review guide on how to review assessment reports, including when assessing the extent of transformation expected or achieved using this guide

The series of ICAT guidance documents intended to enable users that choose to assess the greenhouse gas (GHG) impacts, sustainable development impacts and transformational impacts of a policy or action to do so in an integrated and consistent way within a single impact assessment process. For example, users assessing a renewable energy policy or action could follow both the ICAT *Renewable Energy Methodology* to assess the GHG impacts and this *Transformational Change Methodology* to assess transformational impacts within an integrated assessment. Refer to the ICAT *Introductory Guide* for more information about the ICAT guidance documents and how to apply them in combination.

1.7 Process for developing the methodology

The methodology has been developed through an inclusive, multi-stakeholder process convened by the Initiative for Climate Action Transparency. The development is led by UNEP DTU Partnership (lead) and World Resources Institute (co-lead) who serve as the Secretariat and guide the development process.

The first draft was developed by drafting teams, which consist of a subset of a broader Technical Working Group and the Secretariat. The Technical Working Group consists of experts and stakeholders from a range of countries identified through a public call for expressions of interest. The Technical Working Group contributed to the development of the technical content for the methodology through participation in regular meetings and written comments. A Review Group provided written feedback on the first draft.

The May 2018 version of this methodology was applied by ICAT participating countries and other non-state actors to ensure that it can be practically implemented. This version of the methodology was informed by the feedback gathered from that experience and includes case studies from those applications.

ICAT's Advisory Committee provides strategic advice to the initiative. More information about the development process of the ICAT guidance documents, including governance of the initiative and the participating countries, is available on the ICAT website.

All contributors are listed in the *Contributors* section.

2. Objectives of Assessing Transformational Change

This chapter provides an overview of the objectives users may have in assessing the extent of transformation expected or achieved by policies and actions. Determining the assessment objectives is an important first step, since decisions made in later chapters should be guided by the stated objectives.

Checklist of key recommendations

- Determine the objectives of the assessment at the beginning of the impact assessment process

Assessing the extent of transformation expected or achieved by policies and actions is a key step towards developing strategies that promote climate and sustainable development goals. It enables policymakers to understand the relationship between policies or actions and the expected or achieved transformational impacts, and supports decision making.

It is *a key recommendation* to determine the objectives of the assessment at the beginning of the impact assessment process. Examples of objectives for assessing the transformational impacts of a policy or action are listed below.

General objectives

- **Understand how policy or action helps achieve multiple goals** at international, national or subnational levels. These may include mitigation and sustainable development goals, such as those outlined as part of a country's green growth plans, long-term vision on climate action (e.g., Mexico's Climate Change Mid-Century Strategy), Nationally Determined Contributions (NDCs), or Sustainable Development Goals (SDGs).
- **Attract finance** by demonstrating how a given policy or action facilitates a paradigm shift to low carbon development. Increasingly, funds such as the Climate Investment Funds, NAMA Facility and the Green Climate Fund are paying more attention to understanding how to operationalize transformational change in climate finance.
- **Report and communicate** the extent of transformation expected or achieved by policies or actions to demonstrate results and ambition, build coalitions of support, and raise social acceptance. The assessment results can be reported domestically or internationally, including under the Paris Agreement's enhanced transparency framework for ex-ante reporting of expected impacts or ex-post reporting of achieved impacts.

Objective of assessing expected impacts before policy implementation

- **Improve policy selection and design** by providing a better understanding of the extent of transformation expected by a given policy or action. The assessment can also help compare and prioritize policies or actions based on their potential for paradigm shift. Users can utilize the assessment results to select the most transformational policy or action or adjust current policy objectives and design to increase its potential to be transformational. The process of assessing transformational change can itself also be helpful to inform policy design, for example, by understanding the various characteristics of transformational change.

Objective of assessing impacts during or after policy implementation

- **Evaluate the transformational impact of a policy or action over time** to understand whether, and to what extent, it has been transformational. The assessment can also improve the likelihood of policies or actions realizing their transformational potential when it is conducted regularly and policies or actions are adjusted based on its findings.
- **Inform future policy design**, including reformulation of NDCs toward enhanced ambition, and decide whether to continue current actions, enhance current actions or implement additional actions
- **Learn from experience and ongoing monitoring** to better understand the drivers of transformational change and further enhance the effectiveness of policies and actions.

Users should also identify the intended audience(s) of the assessment report. Possible audiences may include policymakers, civil society organizations, businesses, donors, financial institutions, research institutions or other stakeholders affected by or who can influence the policy. For more information on identifying stakeholders, refer to the ICAT *Stakeholder Participation Guide* (Chapter 5).

Subsequent chapters provide flexibility to enable users to choose how best to assess the extent of transformation expected or achieved by policies and actions in the context of their objectives. The appropriate level of accuracy and completeness is likely to vary by objective. Users should assess the impacts of policies and actions with a sufficient level of accuracy and completeness to meet the stated objectives of the assessment as identified in this chapter.

3. UNDERSTANDING TRANSFORMATIONAL CHANGE

This chapter introduces the concept of transformational change in the context of climate change mitigation and sustainable development. It builds on the scientific literature on sustainability transitions[4] and defines transformational change for the purposes of this methodology.

3.1 Transformational change in the literature

Within social science many scholars have sought to understand how technological and societal changes occur and conceptualize how political, social and technical paradigms transform from one state to another. This has led to a number of observations on historical change processes and analysis of their drivers, with an aim to distill common characteristics of how these changes occurred. It has also led to several attempts to define what constitutes transformational change in general. Table 3.1 illustrates some recent definitions of transformational change.

Table 3.1: Examples of definitions of transformational change

Definition	Source
A transition is a radical, structural change of a societal (sub)system that is the result of a coevolution of economic, cultural, technological, ecological and institutional developments at different scale levels.	Rotmans & Loorbach, 2009
Transitions are non-linear processes that can result from the interplay of multiple developments at three analytical levels: niches (the locus for radical innovations), socio-technical regimes (the locus of established practices and associated rules), and an exogenous socio-technical landscape.	Geels 2012
The altering of fundamental attributes of a system (including value systems; regulatory, legislative or bureaucratic regimes; financial institutions; and technological or biological systems).	IPCC 2012
A structural change that alters the interplay of institutional, cultural, technological, economic and ecological dimensions of a given system. It will unlock new development paths, including social practices and worldviews.	Mersmann et al. 2014
Transformational change through Nationally Appropriate Mitigation Actions (NAMAs) is a change that: Disrupts established high-carbon pathways, contributes to sustainable development and sustains the impacts of the change (goal criteria), Is triggered by interventions of actors who innovate low carbon development models and actions, connect the innovation to day-to-day practice of economies and societies, and convince other actors to apply the innovation to actively influence the multi-level system to adopt the innovation process (process criteria), Overcomes persistent barriers toward the innovated low carbon development model and/or creates new barriers which hinder the transformed system to relapse into the former state (‘low-carbon lock-in’ criteria).	Olsen & Fenhann, 2016

[4] The literature tends to use "transition" and "transformation" interchangeably to convey processes that are referred to as "transformational change" in this methodology.

A transformation is a long-term fundamental shift in a system, whether political, economic, social or biological. Transformations are typically viewed as multi-actor, multi-scale processes, where the change is highly non-linear. Low-carbon energy transformations have three characteristics: large magnitude impact; non-linear change; sustained and long-term.	Westphal & Thwaites 2016
Irreversible, persistent adjustment in societal values, outlooks and behaviours of sufficient width and depth to alter any preceding situation.	TRANSIT 2017

Some general attributes of transformational change processes can be distilled from these definitions:

- Transformational change is a change of **systems**, not just singular developments, and involves multiple actors at multiple levels
- Transformational change constitutes deep, **fundamental change** that **disrupts** the status quo, and sustains that change over a long period of time
- Transformational change by itself has **no normative connotation**; values are added by **defining a transformation goal**

Throughout this methodology, the term "system" is used to describe the part of society that is targeted by a particular policy or action. A system generally refers to a set of interconnected elements working together with some degree of harmony to fulfill various functions. These elements can be physical entities, such as humans or machines, as well as legislative, institutional, political or fiscal structures, or financial rules and regulations organized to achieve a set of objectives and functions. Box 3.1 further distinguishes transformational change from other types of change.

Box 3.1: Types of change

Policies and actions are about planned interventions for change, this has always been the case. What is then new and different about transformational change compared to other types of change? One way to answer this is to distinguish between incremental change, reform and transformation as shown in the table below. Transformational change explicitly leads to a new system, i.e. a new paradigm or regime, new attitudes and values, while questioning the old ones. These are not mutually exclusive types of change. For instance, incremental change and reform can contribute to an enabling environment for transformative change.

	Types of change		
Examples	**Incremental**	**Reform**	**Transformation**
Waste	Less waste (waste regime)	Waste recycling (waste regime)	Cradle to Cradle no waste regime)
Racism	Reduction of discrimination (racial segregation regime)	More rights for the discriminated (racial segregation regime)	Same rights for all (no racial segregation)
Climate change mitigation	Increasing energy efficiency	Promoting renewable energies	Abandoning fossil energy, using 100% renewables

	(lower carbon regime)	(low carbon regime)	(carbon neutral regime)

Source: GIZ (forthcoming).

Societal systems are complex, exhibiting dynamic, non-linear as well as linear and sometimes unpredictable change. Therefore, it may not always be possible to identify a complete chain of causal processes, but even a partial understanding of these dynamics of change can help develop policy interventions that are more likely to lead to transformation. Processes that aim at transformational change will most often not be effective if they target issues in isolation. In such a case, everyone involved could act perfectly dutifully and rationally and with good intent and still produce unintended side effects that no one wants. Inhibitors to change may be rooted in the internal structure of complex systems, and thus finding a solution in one part of the system may cause unintended problems in another part of the system. Therefore, it is essential that the design of a transformative intervention takes its entire systemic context into consideration.

Transformational change as a systemic process affects different parts of society. Because subsystems typically overlap, even small change processes do not have completely isolated impacts. Taking a systemic view means to expect and plan for transformations at many levels, ranging from the local level up to changes at the national or even international levels. Not only do large policy interventions have impacts at lower levels of governance, but local-level activities can also have impacts on higher levels, for example, through learning about successes or when effects of local intervention have bearings on other regions or countries.

Transformational change in this methodology is a conceptual framework to describe the impact of a change process. Transformations can lead to a better as well as a worse state, so the desired direction of change (i.e., to a better state) needs to be defined. Transformational change in relation to climate change is inseparably connected to sustainable development. Therefore, this methodology is problem oriented towards promoting zero-carbon, climate-resilient, resource-efficient and sustainable societies, in line with the goals of the Paris Agreement and the UN Sustainable Development Goals.

3.2 Definition of transformational change in this methodology

As transformational change as a concept is gaining significant traction among climate change and sustainable development decision makers and practitioners, there is a need for a comprehensive definition specific to climate change mitigation grounded in both theory and practice.

With this background, transformational change is defined in this methodology as:

> **A fundamental, sustained change of a system that disrupts established high-carbon practices and contributes to a zero-carbon society in line with the Paris Agreement goals to limit global warming to 1.5 - 2°C and the UN Sustainable Development Goals.**

The terms carbon and CO_2 are used interchangeably in this methodology. Zero carbon refers to zero CO_2 equivalent emissions and takes into account other greenhouse gas emissions. Zero carbon means “net zero carbon emissions”, which implies that some remaining CO_2 can be compensated by the same amount of CO_2 up-take as long as the net emissions to the atmosphere is zero. The vision is to phase out fossil fuel emissions and phase in a 100% renewable energy society.

Further, transformational change as defined above is characterized by:

- **Large-scale outcomes or a multitude of smaller-scale changes coherently leading to large-scale system impacts**
- **Sustained, long-term, irreversible outcomes that reinforce zero-carbon practices**

Transformational change as considered in this methodology is not an organic or incremental evolution in line with the self-organizing dynamics of a system. Instead, transformational change means the general paradigm and existing standards of how to do things are challenged and old path dependencies are disrupted. The kind of transformational change in focus here is the “planned' transformation,’ that is, the transformation that is intended through the adoption of purposeful policy and regulation aiming at shifting emission trends towards zero-carbon and sustainable development goals. This requires an intentional, long-term change strategy as to how the system can transform and what the outcome of transformation should be. The methodology identifies four main drivers (or processes) of change based on the existing literature on transformational change:

- **Technology change**: This refers to processes, skills and practices that drive research and development, early adoption and widespread scale-up of clean technologies.
- **Agents of change**: This pertains to governments, entrepreneurs, the private sector and civil society, as well as cross-cutting coalitions and networks as agents of transformational change.
- **Incentives for change**: This refers to economic and non-economic incentives along with disincentives, which play a critical role in shifting technology and societal change.
- **Norms and behavioural change**: This includes processes that influence awareness and behaviour of people to drive a long-lasting change in societal norms and practices.

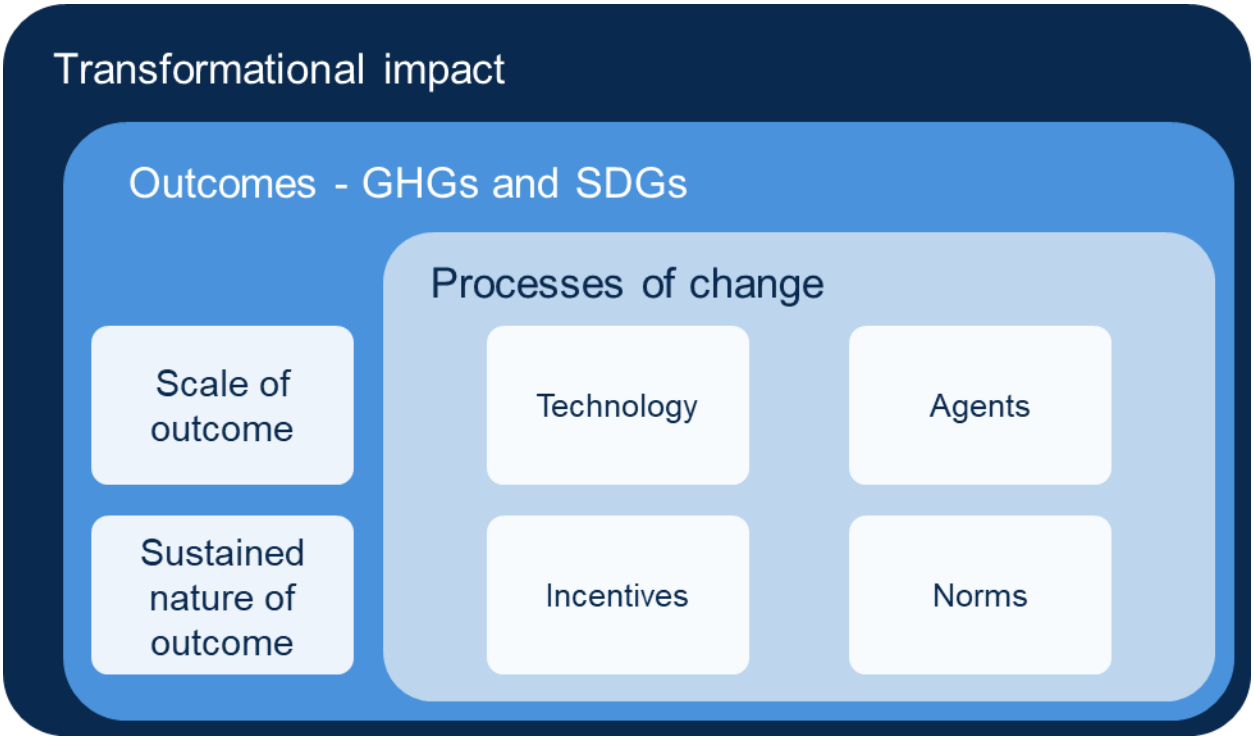
Although transformational change is context-dependent, in order for it to occur, all four processes listed above are considered important and interdependent as elements of the system targeted for change. Only seldom can development be anticipated with a long-term (e.g., 20 or more years) perspective so a long-term management strategy is equally necessary. Strategies and implementation modalities should be adapted to technology development, changes in norms, and changes in the economy. Effective and adaptive change management strategies as well as continuous learning are critical elements.

Case studies of transformations for low-carbon and sustainable development are available in the literature.[5] To learn from successful examples of transformations ongoing or planned, the studies focus on experience with transformation of the energy system in Germany; the role of wind power in electricity generation in Denmark; the reduction in deforestation in Brazil (75% over a decade from 2005 to 2014)[6]; the transition to a sustainable transport system at city level in Bogotá, Columbia; and the role of state-owned companies to lead a transition away from high-carbon lock-in in South Africa. Figure 3.1 illustrates the logic of this methodology. The assessment of transformational impact consists of assessment of processes and outcomes of change, all of which are supported by a number of characteristics and indicators.

[5] Olsen & Fenhann, 2015.

[6] Deforestation in Brazil is on the rise since 2014. Monitoring over time will show, whether the gains achieved earlier will be sustained eventually.

Figure 3.1: Layers of transformational impact assessment



The layers of the assessment follow the layers of the definition of transformational change:

- The extent of the overall transformational impact is assessed through the policy or action's contribution to a system change towards zero-carbon and sustainable development goals.
- The outcomes of a transformational policy or action are determined through its contribution to achieving GHG mitigation and sustainable development at a large scale that is sustained over time.
- The processes of a transformational policy or action comprise technologies, change agents, economic incentives, and a change of norms and behaviour, as well as effective change management that is open to continuous learning and integration of changing circumstances.

4. STEPS AND ASSESSMENT PRINCIPLES

This chapter introduces an overview of the steps involved in the assessment of the extent of transformation expected or achieved by policies and actions and gives the principles of impact assessment.

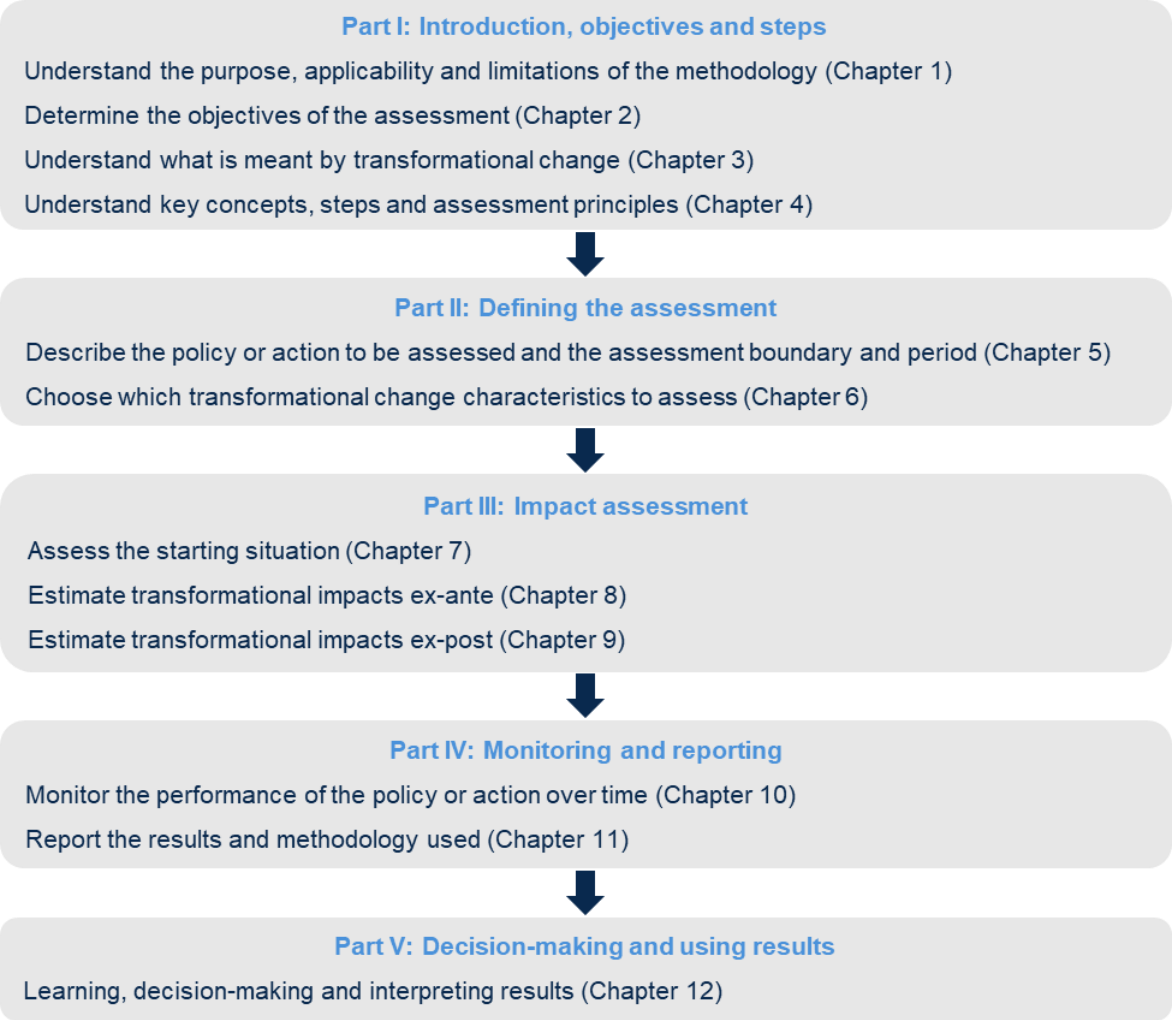
Checklist of key recommendations

- Base the assessment on the principles of relevance, completeness, consistency, transparency, accuracy and reflection on ambition

4.1 Overview of steps

This methodology is organized in terms of the steps a user follows in assessing transformational impacts of a policy or action (Figure 4.1). Depending on when the methodology is applied, users can select Chapter 8 or Chapters 9 and 10. For example, when the methodology is applied ex-ante before a policy is implemented, users can skip Chapters 9 and 10.

Figure 4.1: Overview of steps



4.1.1 Planning the assessment

Users should review this methodology, the Introductory Guide and other relevant methodology documents, and plan the steps, responsibilities and resources needed to meet their objectives for the assessment. Identify in advance the expertise and data needed for each step, plan the roles and responsibilities of different actors, and secure the budget and other resources needed. Any interdependencies between steps should be identified, for example where outputs from one step feed into another, and timing should be planned accordingly.

It is important to plan the steps, responsibilities and resources needed to meet the objectives for assessing transformational impacts. The time and human resources required to use the methodology in its entirety depend on a variety of factors, such as the complexity of the policy or action being assessed, the range of transformational change characteristics and corresponding indicators included in the assessment, the extent of data collection needed and whether relevant data has already been collected, and whether similar analysis related to the policy or action has previously been done. An Assessment Template is provided for users on the ICAT website. The template indicates the type of data needed to arrive at assessment results, which is useful for planning the assessment.

Quantifying impacts of the policy or action

To assess the extent of transformation of a policy or action, it is necessary to first understand the impacts of a policy or action in terms of its GHG and sustainable development impacts. To do so, users can apply other ICAT methodologies in combination with this methodology. To assess the GHG impacts of the policy or action, users can apply the GHG methodology that is relevant to the policy or action—*Renewable Energy Methodology*, *Buildings Efficiency Methodology*, *Transport Pricing Methodology*, *Agriculture Methodology* or *Forest Methodology*. To assess the various sustainable development impacts of the policy or action, users can apply the ICAT *Sustainable Development Methodology.* This includes many different types of impacts across the environmental, social and economic dimensions, such as air quality, health, jobs, income, gender equality and energy security, among many others.

Planning stakeholder participation

Stakeholder participation is recommended in many steps throughout the methodology. It can strengthen the impact assessment and the impact of policies in many ways, including by:

- Establishing a mechanism through which people, who may be affected by or can influence a policy, have an opportunity to raise issues and have these issues considered before, during and after the policy implementation
- Raising awareness and enabling better understanding of complex issues for all parties involved, building their capacity to contribute effectively
- Building trust, collaboration, shared ownership and support for policies among stakeholder groups, leading to less conflict and easier implementation
- Addressing stakeholder perceptions of risks and impacts and helping to develop measures to reduce negative impacts and enhance benefits for all stakeholder groups, including the most vulnerable

- Enhancing the credibility, accuracy and comprehensiveness of the assessment, drawing on diverse expert, local and traditional knowledge and practices, for example, to provide inputs on data sources, methods, and assumptions
- Enhancing transparency, accountability, legitimacy and respect for stakeholders' rights
- Enabling enhanced ambition and finance by strengthening the effectiveness of policies and credibility of reporting

Various sections throughout this methodology explain where stakeholder participation is recommended—for example, in choosing which transformational change characteristics to assess (Chapter 6), identifying barriers to transformational change (Chapter 6), qualitatively assessing impacts (Chapters 8 and 9), monitoring performance over time (Chapter 10), reporting (Chapter 11) and decision making and using results (Chapter 12).

Before beginning the assessment process, consider how stakeholder participation can support the objectives and include relevant activities and associated resources in the assessment plans. It may be helpful to combine stakeholder participation for transformational impact assessment with other participatory processes involving similar stakeholders for the same or related policies, such as those being conducted for the assessment of GHG and sustainable development impacts and for technical review.

It is important to ensure conformity with national legal requirements and norms for stakeholder participation in public policies, as well as requirements of specific donors and of international treaties, conventions and other instruments that the country is party to. These are likely to include requirements for disclosure, impact assessments and consultations, and may include specific requirements for certain stakeholder groups (e.g., UN Declaration of the Rights of Indigenous Peoples, International Labour Organization Convention 169) or specific types of policies and actions (e.g., UNFCCC guidance on safeguards for activities reducing emissions from deforestation and degradation in developing countries).

During the planning phase, it is recommended to identify stakeholder groups that may be affected by or may influence the policy. Appropriate approaches should be used to engage with the identified stakeholder groups, including through their legitimate representatives. To facilitate effective stakeholder participation, consider establishing an inclusive multi-stakeholder working group or advisory body that includes representatives from all identified stakeholder groups and experts with relevant and diverse knowledge and experience. Such a group may advise and potentially contribute to decision making to ensure that stakeholder interests are reflected in design, implementation and assessment of policies, including on stakeholder participation in the assessment of transformational impacts of a particular policy. It is also important to ensure that stakeholders have access to a grievance redress mechanism to secure adequate protection of stakeholders' rights related to the impacts of the policy.

Refer to the ICAT *Stakeholder Participation Guide* for more information, such as how to plan effective stakeholder participation (Chapter 4), identify and analyze different stakeholder groups (Chapter 5), establish multi-stakeholder bodies (Chapter 6), provide information (Chapter 7), design and conduct consultations (Chapter 8) and establish grievance redress mechanisms (Chapter 9). Appendix B: Stakeholder Participation During the Assessment Process summarizes the steps in this document where stakeholder participation is recommended along with specific references to relevant information in the *Stakeholder Participation Guide*.

Planning technical review (if relevant)

Before beginning the assessment process, consider whether technical review of the assessment report will be pursued. The technical review process emphasises learning and continual improvement and can help users identify areas for improving future impact assessments. Technical review can also provide confidence that the impacts of policies have been estimated and reported according to ICAT key recommendations. Refer to the ICAT *Technical Review Guide* for more information on the technical review process.

4.2 Assessment principles

Principles are intended to underpin and guide the impact assessment process, particularly where the methodology provides flexibility.

It is a *key recommendation* to base the assessment on the principles of relevance, completeness, consistency, transparency, accuracy and reflection on ambition, as follows[7]:

- **Relevance:** Ensure the assessment serves the decision-making needs of users and stakeholders. Provide sufficient information to serve the intended purpose and meet the expectations and objectives of users.
- **Completeness:** Assess all relevant and significant characteristics of transformational change related to a policy or action, and complete each relevant step in the assessment.
- **Consistency:** Use consistent approaches and data collection methods to allow for meaningful results and performance tracking over time. Any changes to data, assessment methods or any other relevant factor should be transparently documented and reported as applicable.
- **Transparency:** Provide clear and complete information for stakeholders to determine the credibility and reliability of results. Disclose all relevant methods, data sources, assumptions and uncertainties as far as feasible.
- **Accuracy:** Ensure use of appropriate methods and data and valid assumptions to enhance accuracy and reliability of results and engage stakeholders to ensure an unbiased assessment. It may be necessary to balance the need for accuracy with available resources and users' capacity, particularly considering the largely qualitative nature of transformational impact assessment. Where accurate data is not available, users should strive to improve accuracy over time as better data becomes available.
- **Reflection on ambition:** Be problem oriented, always have a clear rationale, and focus on how the policy or action contributes to transformational change at every step of the assessment. Conduct iterative and reflexive monitoring and ongoing adjustment of transition goals and strategies towards progression and ambition of policies and actions to become more effective, efficient and scale up transformational impacts.

[7] These principles build on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories to ensure quality in all steps of the assessment (IPCC 2006).

In addition to the principles above, users should follow the principle of comparability if it is relevant to their assessment objectives, for example, if the objective is to compare and prioritize multiple policies based on the extent of transformation expected or achieved by them.

- **Comparability:** Ensure common methods, data sources, assumptions, and reporting formats are used in assessments so that the estimated impacts of multiple policies can be compared. While the principle of consistency refers to being consistent in the use of methods, data and other aspects of the assessment over time in assessing a given policy or action, comparability is about commonality in assumptions and methodologies between assessments of different policies.

The principle of comparability can be applied when the objective is for a single entity to assess and compare multiple policies or actions using the same methodology. If the objective is to compare multiple assessment reports of policies carried out by different entities, it is important to exercise greater caution. Differences in reported results may be due to differences in methodology rather than real-world differences. Additional measures are necessary to enable valid comparisons in these situations, such as ensuring consistency in the assessment period, the characteristics and indicators assessed and monitored, the starting situation, calculation methods, and data sources. To understand whether comparisons are valid, all methodologies, assumptions, and data sources used should be transparently reported.

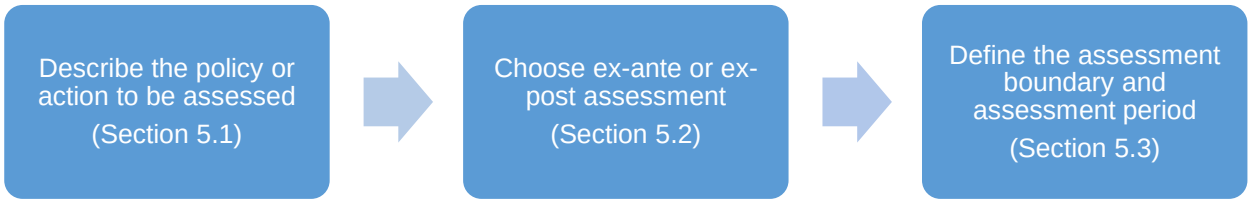
In practice, users may encounter trade-offs between principles when carrying out an assessment. For example, users may find that achieving the most complete assessment requires using less accurate data for a part of the assessment, which could compromise overall accuracy. Conversely achieving the most accurate assessment may require excluding sources with low accuracy which compromises completeness. Users should balance trade-offs between principles depending on their assessment objectives. Over time, as the accuracy and completeness of data increases, the trade-off between these principles will likely diminish.

PART II: DEFINING THE ASSESSMENT

5. DESCRIBING THE POLICY OR ACTION AND THE ASSESSMENT BOUNDARY AND PERIOD

To assess the transformational impacts of a policy or action, users need to describe the policy or action that is assessed, decide whether to assess an individual policy or action or a package of related policies or actions, and choose whether to carry out an ex-ante or ex-post assessment. This chapter also explains how to define the assessment boundary and assessment period.

Figure 5.1: Overview of steps in Chapter 5



Checklist of key recommendations

- Clearly describe the policy or action (or package of policies or actions) that is being assessed
- Define the assessment boundary in terms of geographical and sectoral coverage of transformational characteristics selected for assessment
- Define the assessment period

5.1 Describe the policy or action to be assessed

A comprehensive and structured description of the policy or action is necessary to carry out the assessment in subsequent steps. It is a *key recommendation* to clearly describe the policy or action (or package of policies or actions) that is being assessed. Table 5.1 provides a checklist of recommended information to be described to enable an effective assessment.

When multiple policies and actions are being developed or implemented in the same timeframe or as part of the same broad strategy or plan, users can assess the policies or actions either individually or together as a package. When making this decision, it is useful to consider the assessment objectives, feasibility and degree of interaction between the individual policies and actions under consideration. Further methodology on whether to assess an individual policy or action or a package of policies and actions is available in the sector specific ICAT GHG methodology and *Sustainable Development Methodology*. Users that are assessing the GHG impacts and/or sustainable development impacts of the policy or action following other ICAT methodology should define the policy or policy package in the same way to ensure a consistent and integrated assessment, or explain why there are differences in how they are defined across the assessments.

When a package is assessed, users should explain which individual policies and actions are included in the package and how they contribute to a transformational vision. Table 5.1 can be used to document either the package as a whole or each policy in the package separately. In subsequent chapters, users

follow the same general steps and methodology, whether they choose to assess an individual policy or action or a package of policies and actions.

Table 5.1: Checklist of recommended information to understand and describe the policy or action

Information	Description	Example
Title of the policy or action	Policy or action name	Grid-Connected Solar Rooftop Programme. Throughout this methodology, it is referred to as the "Solar PV policy"
Type of policy or action	The type of policy or action such as those presented in Table 1.1, or other categories of policies or actions that may be more relevant	Financial incentive policy
Description of specific interventions	The specific intervention(s) carried out as part of the policy or action, such as the technologies, processes or practices implemented to achieve the policy or action	Description of financial incentives: The policy includes two specific interventions: 1) A financial subsidy up to 30% of project/benchmark cost for rooftop solar projects (up to 500KW) in the residential/institutional and social sectors. It also provides concessional loans to solar rooftop project developers. 2) A feed-in tariff for all new grid-connected solar rooftop and small solar power plants
Status of the policy or action	Whether the policy or action is planned, adopted or implemented	The policy has been implemented (currently in effect)
Date of implementation	The date that the policy or action comes into effect (not the date that any supporting legislation is enacted)	1 January 2016
Date of completion (if relevant)	The date the policy or action ceases, such as the date a tax is no longer levied or the end date of an incentive scheme with a limited duration (not the date that the policy/action no longer has an impact)	The provision of financial incentives and feed-in tariff ends on 31 December 2022
Implementing entity or entities	The entity(ies) that implement(s) the policy or action, including the role of various local, subnational, national, international or any other entities	Government funds are disbursed by the ministry to state agencies, financial institutions, implementing agencies and other government approved partners that include renewable energy service providers, system integrators, manufacturers, vendors and NGOs. The feed-in tariff is determined at a national level by an electricity regulatory authority and is administered by the electricity utility companies.

Objectives and intended impacts or benefits of the policy or action	The intended impact(s) or benefit(s) the policy or action intends to achieve (e.g., the purpose stated in the legislation or regulation), including specific goals for GHG emission reductions and sustainable development impacts where available	The policy is intended to increase deployment of solar energy, deepen solar technology penetration, increase access to clean energy, increase energy security, create jobs, reduce greenhouse gas emissions, and create an enabling environment for technology penetration, investment, installation, capacity building, research and development in the solar energy sector. The policy has set the following goals: 1) Annual emission reductions of 20 Million tCO_2e by 2022, 2) 200,000 new green jobs (e.g., in solar PV installation and maintenance sectors) created by 2022
Level of the policy or action	The level of implementation, such as national level, subnational level, city level, sector level or project level	National
Geographic coverage	The jurisdiction or geographic area where the policy or action is implemented or enforced, which may be more limited than all the jurisdictions where the policy or action has an impact	National
Sectors targeted	Which sectors and subsectors are targeted	Energy supply, grid-connected solar PV
Other related policies or actions	Other policies or actions that may interact with the policy or action assessed	The Government targets installation of 100 GW of solar power by 2022 of which 40 GW is to be achieved through rooftop solar power plants through the solar PV policy.
Reference	Include a link or full reference to access further, detailed information about the policy or action	www.solarpvpolicy.org

5.2 Choose ex-ante or ex-post assessment

Users should choose whether to carry out an ex-ante assessment, ex-post assessment, or a combined ex-post and ex-ante assessment. An assessment is classified as either ex-ante or ex-post depending on whether it is prospective (forward-looking) or retrospective (backward-looking). Ex-ante assessment is the process of assessing expected future impacts of a policy or action. Ex-post assessment is the process of assessing historical impacts of a policy or action. Ex-ante assessment can be carried out before or during policy implementation, while ex-post assessment can be carried out either during or after policy implementation.

Choosing between ex-ante or ex-post assessment depends on the status of the policy or action:

- If the policy or action is planned or adopted, but not yet implemented, the assessment will be ex-ante by definition.
- If the policy or action is under implementation, the assessment can be either ex-ante, ex-post or a combination of the two. Users should carry out an ex-post assessment when the objective is to assess the extent of transformation achieved by the policy or action to date; an ex-ante assessment when the objective is to assess the extent of transformation expected in the future, or a combined ex-ante and ex-post assessment to assess both the extent of transformation expected and achieved by the policy or action.

5.3 Define the assessment boundary and assessment period

The assessment boundary and assessment period define the scope of the assessment. The assessment boundary defines the scope of the assessment in terms of the transformational impacts covered and geographical and sectoral coverage of the policy or action.

This methodology encourages a comprehensive assessment that includes the full range of characteristics considered to be relevant. For this reason, the assessment boundary can be broader than the geographic and sectoral boundary within which the policy or action is implemented. If a policy is implemented within one sector in a country, but has significant impacts in other sectors or in neighboring countries, users can consider an assessment boundary that includes impacts in these other sectors or countries where feasible. All specific and relevant characteristics of transformational change identified are to be included in the assessment boundary. A two-step approach to defining the assessment boundary and the assessment period is recommended. The first step is to define the boundaries based on the description of the policy or action. The second, iterative step is to revisit and revise the definition of boundaries, after the transformational impacts have been selected in Section 6.5.

It is a *key recommendation* to define the assessment boundary in terms of geographical and sectoral coverage of transformational characteristics selected for assessment. Users define the assessment boundary in terms of the impacts covered, geographical coverage and sectoral coverage as follows:

- **Impacts covered**: Along with GHGs, users should specify which sustainable development impact categories are selected for assessment. The ICAT *Sustainable Development Methodology* (Chapter 5) provides a list of impact categories across the environmental, social and economic dimensions that can be included in the assessment, such as jobs, air quality, health, GDP, gender equality, water quality, and energy security. For the solar PV policy example, jobs is the only sustainable development impact category selected for assessment in addition to GHGs.

- **Geographical coverage***:* Users can undertake the assessment at global, national, state or city-level. This may or may not be distinct from the geographic coverage of the policy. For example, users can undertake a regional or national assessment of a policy such as the European Union Emissions Trading Scheme which applies to the entire EU region. In case of a national policy, users can conduct the assessment at a national level or at a state level to understand, whether the policy is likely to result in transformational change in a state. For the solar PV policy example, the assessment is undertaken at the national level.

- **Sectoral coverage***:* Users should specify the sector(s) included in the assessment. These can be the same or a subset of sectors targeted by the policy or action. Users should include at least the major sector(s) affected by the policy in their assessment. For the solar PV policy, users could

undertake the assessment for the entire electricity sector, the renewable energy sector, or the narrower solar PV subsector. In the example used in the methodology, the assessment covers the solar PV subsector only.

The assessment period is the time period over which the extent of transformation expected or achieved by the policy or action is assessed. The assessment period can differ from the policy implementation period, which is the time period during which the policy or action is in effect.

It is a *key recommendation* to define the assessment period. The assessment period can differ from the policy implementation period—the time period during which the policy or action is in effect—and should be as comprehensive as possible to capture the full range of relevant impacts based on when they are expected to occur. Where the objective is to understand the expected contribution of the policy or action toward achieving a country's NDC, it may be most appropriate to align the assessment period with the NDC implementation period (e.g., ending in 2030). Similarly, to align the results with the achievement of SDGs under the 2030 Agenda for Sustainable Development, users may define an assessment period ending in 2030. To align with longer-term trends and planning, users should select an end date such as 2040 or 2050. System changes most often unfold over a longer period of time. Also, the sustained nature of impacts may become evident only over the course of time. In the case of ex-post assessments, regular monitoring of impacts is encouraged to enable modification of strategies as needed. For solar PV policy example, the assessment period is 2016-2030 (14 years). Hence, users are encouraged to select a long assessment period (e.g., 15 years or more).

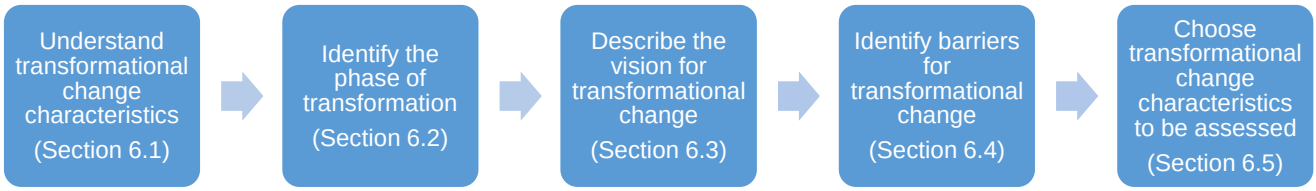
The timing and coverage of data collection to assess characteristics will depend on user's reporting needs as well as the indicators and data sources, on which they are based. If so desired, users can choose to monitor the policy outside the assessment boundary and beyond the assessment period. Chapter 10 provides further methodology on the practical monitoring of indicators over time and within the assessment boundary defined.

Where possible, users should align the assessment period with other assessments being conducted using other ICAT methodologies. For example, where users are assessing sustainable development impacts using the ICAT *Sustainable Development Methodology* in addition to assessing transformational impacts, the assessment period should be the same for both the sustainable development and transformational impact assessment.

6. Choosing Which Transformational Change Characteristics To Assess

This chapter provides a framework to understand transformational change characteristics. It outlines the steps and methodology to choose transformational change characteristics relevant for a policy or action. Identifying the phase of transformation provides an understanding of the starting situation, the context in which the policy or action is implemented. This helps to describe the historical background and possible future pathway towards the vision for transformational change as described by the user. Identifying barriers for transitioning the system specific to the phase of transformation is useful to choose which transformational characteristics to asses.

Figure 6.1: Overview of steps in Chapter 6



Checklist of key recommendations

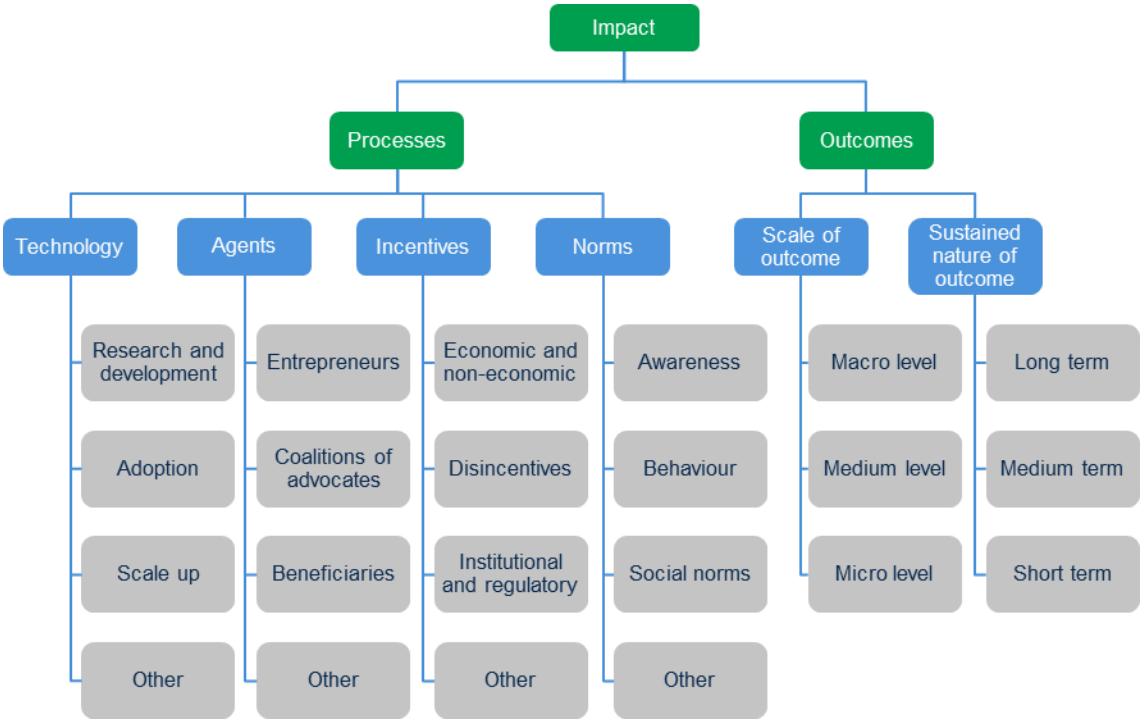
- Identify the phase of transformation to understand the context in which the policy or action is being planned or implemented
- Describe the transformational vision of the policy or action, through consultation with key stakeholders
- Identify barriers to transformational change specific to the phase of transformation
- Choose characteristics to be assessed based on their relevance to transformational change in the context of the policy or action and the society in which it is implemented

6.1 Understand transformational change characteristics

This section explains characteristics of transformational change to help users understand the transformational impacts of a policy or action. The characteristics provide a generic framework to describe all transformational aspects of a policy or action regardless of where it is implemented.

Figure 6.2 illustrates the framework of characteristics of transformational impact. There are two types of impacts: outcomes and processes. Within each type there are categories and within the categories, there are characteristics. Together the outcome and process impacts are used to determine the extent to which a policy or action is transformational. In later chapters all policies and actions are assessed against the framework of characteristics for transformational impact.

Figure 6.2: Characteristics of transformational impact



Outcome characteristics

Outcome characteristics refer to the scale and sustained nature of outcomes resulting from a policy or action. Outcomes are measured in terms of GHG emission reductions and selected sustainable development impacts across environmental, social and economic dimensions (e.g., air quality, health, jobs, gender equality and energy security, among others). Users assess both the scale and the sustained nature of GHG and selected sustainable development impacts of the policy or action.

The scale of outcomes refers to the magnitude of impacts affected by the policy or action. Making a policy more transformational involves enhancing the ambition of a policy from small-scale to large-scale outcomes as well as affecting a greater population to result in changes of large magnitude. While the focus is on large-scale changes, it is important to note that multiple small-scale changes can collectively lead to large-scale changes or a single small-scale change can trigger a large-scale change over time. What constitutes as large depends on the context and the chosen assessment boundary. For example, large emission reductions at sectoral level can be considerably smaller than what would be considered large at a national level and yet the level of reduction may be transformational for the sector chosen.

To assess the magnitude of impacts, users can refer to the various ICAT GHG methodology documents (for assessing GHG impacts) and the ICAT *Sustainable Development Methodology* (for assessing the magnitude of various sustainable development impacts; in particular, see Chapter 7 for a qualitative approach to classifying impacts as major, moderate, or minor, and Chapters 8-10 for methodology on quantifying impacts). Furthermore, policies may have positive as well as negative impacts on sustainable development and climate mitigation. Negative impacts may include loss of employment, reduced production in different sectors and loss of income, especially for fossil-fuel dependent economies such as coal and oil producers. The ICAT *Sustainable Development Methodology* helps to assess synergies and trade-offs between multiple sustainable development impacts. Understanding and managing the negative

impacts and striking a balance across all kinds of impacts are crucial for achieving a just and sustained transformational change. The scale of transformational outcomes is assessed both for climate and sustainable development through separate assessments, while GHG emission reductions is recognized as a priority to achieve a zero-carbon society.

The sustained nature of the outcomes refers to the durable nature of the effects of a policy or action. Making a policy transformational involves expanding support for the policy or action over time and preventing the removal or weakening of transformational impacts of a given policy. This helps to lock-in the change and makes reversal more difficult. Table 6.1 provides an overview of outcome characteristics.

Table 6.1: Outcome categories and characteristics of transformational change

Category	Characteristics	Description of outcome characteristics
Scale of outcome	Macro level	GHG outcome is large in magnitude at international / global level Sustainable development outcome is net positive in magnitude at international/global levels
	Medium level	GHG outcome is large in magnitude at national or sectoral levels Sustainable development outcome is net positive in magnitude at national or sectoral levels
	Micro level	GHG outcome is large in magnitude at subnational, subsector, city or local levels Sustainable development outcome is net positive in magnitude at subnational, subsector, city or local levels
Outcome sustained over time	Long-term	GHG outcome is achieved and sustained ≥15 years from the starting situation Sustainable development outcome is achieved and sustained ≥15 years from the starting situation
	Medium-term	GHG outcome is achieved and sustained ≥5 years and <15 years from the starting situation Sustainable development outcome is achieved and sustained ≥5 and <15 years from the starting situation
	Short-term	GHG outcome is achieved and sustained <5 years from the starting situation Sustainable development outcome is achieved and sustained <5 years from the starting situation

Process characteristics

Process characteristics describe how a policy or action can drive changes in society that enable achievement of transformational impacts. These can be understood as intermediate steps or means to realize transformational outcomes. In this methodology, process characteristics are organized in four categories: technology, agents, incentives and norms. Table 6.2 provides an overview of transformational process characteristics. Users can add ‘Other’ characteristics to each category if there

are changes triggered in society by the policy or action that are not captured in this table (as shown in Figure 6.2). In the last section of this chapter, users will choose process characteristics relevant for their assessment.

Table 6.2: Process categories and characteristics of transformational change

Category	Characteristics	Description of characteristics
Technology	**Research and development (R&D):** Policy or action supports R&D for building technological capabilities favouring a low carbon economy	Technological research and development happens through supporting science, innovation, specialization and learning. Investment in R&D, development of the knowledge/skill base, research networks and consortiums, capacity building efforts, and experimentation are examples of activities supporting technological development.
	Adoption: Policy or action leads to early adoption of promising low carbon technologies	Technology adoption can be facilitated by pilot projects, demonstrations, experimentation, publicly or privately funded trials of low carbon technologies. This helps in assessing the market for new technologies, developing skills and capacities to use them, and building networks to support new solutions. It can be understood as the initial phase when an entity first gains knowledge of, develops an understanding or opinion about, experiments with or rejects an innovation.
	Scale up: Policy or action supports scale up and diffusion of low carbon innovations	Technology scale up can be facilitated by replication, diffusion through public-private sector networks, training workshops, business forums and applying innovative ways to conduct business and deliver products and services at a larger, more widespread scale.
Agents	**Entrepreneurs:** Policy or action promotes entrepreneurs, businesses and investors to catalyze transformational change	Actors, such as entrepreneurs innovating and experimenting with new technologies and applications, businesses forming markets, and investors bringing resources to clean technology, are all key agents of change that the policy can support to drive change. Entrepreneurship can be supported by policy or actions by providing an enabling environment to take initiative and risk and by facilitating exchange of information and ideas.
	Coalitions of advocates: Policy or action supports coalitions and networks that seek to broaden and deepen support for low carbon development	The agency of a wide range of stakeholders including those that can provide checks and balances to those representing entrenched interests can be exercised through political mobilization, coalitions, lobbying strategies and engagement in advocacy. New networks of various types of actors, for example, the labour and environmental movements, private-public actors, political and civil society organizations, may come together because of the way the policy was designed.
	Beneficiaries: Policy or action supports diverse groups of society affected by the transformational change which subsequently support the policy	Beneficiaries include those who benefit directly from the policy or action (e.g., solar producers) as well as those who are compensated if the policy has adverse effects (e.g., workers employed in the coal industry that lose their jobs). Beneficiaries can serve as agents of change and play a role in ensuring the policy or action is durable and strengthened over time.

Incentives	**Economic and non-economic:** Policy or action utilizes fiscal and non-monetary incentives to shift technology and increase market penetration	Economic incentives include tariff structures, access to low-cost finance, feed in tariff policies for renewable energy, value added tax (VAT) exemption, import duty exemptions on new technology, and lowered land rates on renewable energy projects. Non-economic incentives include partnerships, giving ownership to local initiatives and communities, long-term institutional and governance support, political support, signing MOUs, and removal of bureaucratic procedures.
	Disincentives: Policy or action de-incentivizes technologies and businesses contributing to a high-carbon economy	Disincentives include taxes on carbon-intensive products, the use of market-based instruments such as import duties, tariff structure discouraging investments in business-as-usual technologies, reduce/phase out fossil fuel subsidies and increase/introduce fossil fuel taxes.
	Institutional and regulatory: Policy or action creates or re-configures existing conditions, including availability of finance for implementation, and putting place regulation and institutions favouring low carbon development	The policy or action leads to a fertile ground for further institutional or regulatory change by the government; for example, the climate policy may lead to the creation of formal and informal institutions, or new regulation over time, or may create steady budgetary allocation toward policy implementation.
Norms	**Awareness:** Policy or action supports awareness raising and education for sustainability transition	This includes raising awareness to enhance the level of support for low carbon solutions to affect a change in norms and behaviour among diverse groups of stakeholders. Examples include awareness campaigns and sensitization of policy makers and consumers, e.g., to inform policymakers about falling prices of renewable energy technologies or for consumers to easily identify more efficient appliances through labelling programs, addressing barriers to adopting new behaviours, disseminating information at various levels of governance, and utilizing local organizations and media to spread information.
	Behaviour: Policy or action supports measures that discourage high-carbon lifestyle and practices and promote low carbon solutions	Examples of measures focused on influencing consumer behaviour include peak energy savings, credit by utilities, cash incentives for using alternate transport, congestion charges for driving in certain areas during busy hours or rewarding recycling or use of public transport.
	Social norms: Policy or action affects norms within society that align with and further promote low carbon, sustainable development	Social norms refer to cultural rules of behaviour that are considered acceptable in a society. As awareness increases and behaviour changes, societal norms change. Policy or action contributes to low carbon lifestyle becoming the prevalent societal norm, which reflects broad and deeply entrenched support within the society. Such impacts may change how natural resources are valued, encourage willingness to pay for pollution, or influence social norms related to household energy consumption or sustainable behavior in general.

Appendix A provides examples of indicators for process and outcome characteristics for a more detailed qualitative and quantitative description of characteristics.

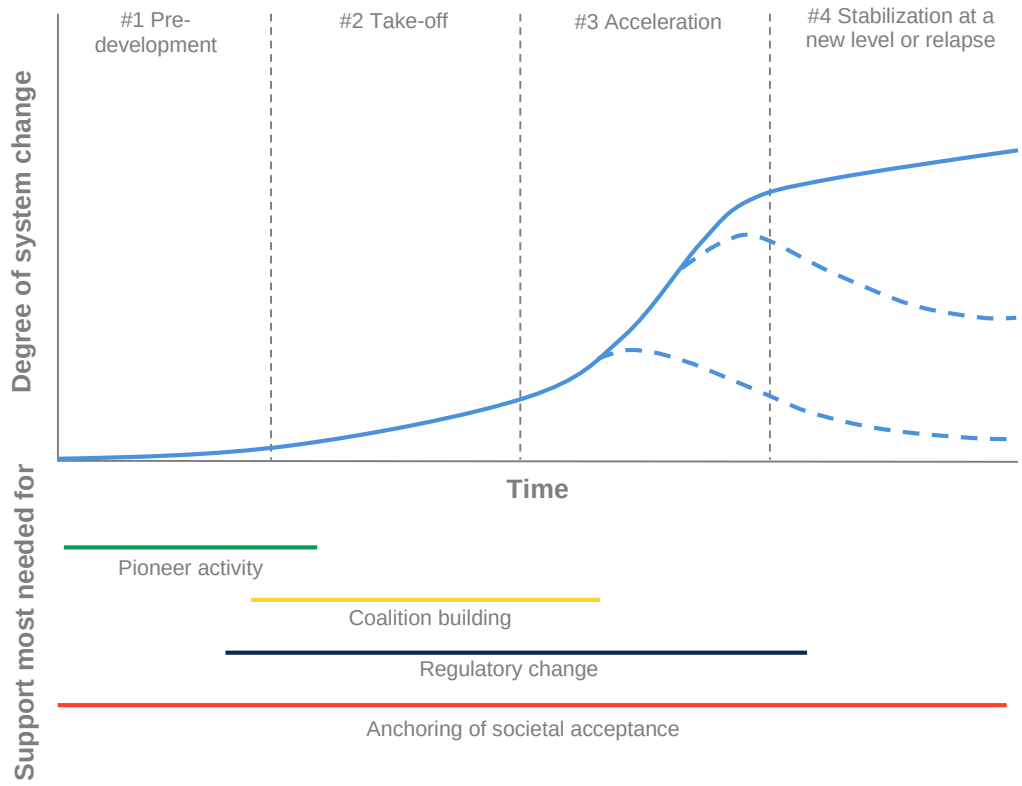
6.2 Identify the phase of transformation

Comprehensively assessing the phase of transformation is a critical step in understanding, whether the policy or action is well-suited to overcoming barriers and driving transformational change. The phase of

transformation explains the economic, social, institutional and political context in which the policy is being planned or implemented. This contextual understanding is important for users to choose and assess process and outcome characteristics in subsequent steps. Different components of the system can be at different stages of transformation towards low-carbon development. For example, while low carbon regulation may be in place, institutional capacity to implement it may be lacking, or while low carbon technological solutions may exist, consumer demand to scale up these solutions may be too weak.

Figure 6.3 shows a framework for the assessment and visualization of the current status of a system, which is on a pathway of transformation towards zero-carbon and sustainable development. It helps answer the question "Where are we today and where are we heading?"

Figure 6.3: Phases of transformation



Source: Mersmann et al. 2014; Adapted Rotmans et al. 2000.

A system undergoing transformation to low-carbon and sustainable development can be described to be in any of the following four phases:

Pre-development

The *pre-development phase* could be described as the comfort zone phase. This is characterized, on the one hand, by visible and increasing pressure on government and policies to make moves towards low-carbon and sustainable development. Often such pressure is generated externally and/or from local civil society. On the other hand, the pre-development stage is also characterized by stability and status quo in which existing or predominant paradigms are rarely challenged and institutions are stagnant or very few attempts are made to change them.

Take-off

The take-off phase is characterized by observable moves being taken to enable change in the system towards more openness and acceptance of new ideas and concepts that question or challenge existing high-carbon paradigms. There is an increasing awareness of problems and issues related to un-sustainable development and concrete attempts of possible solutions. Experimentation, innovation and alternatives are expanding and gaining momentum. However, there is still no consensus or common understanding, about which solutions are suitable from the range that is possible. Lobbying against the new and alternative solutions remains strong, fueled by current regime elites who benefit from the present system.

Acceleration

In the acceleration phase, new solutions or innovations gain momentum and challenge the status quo. Alternative solutions have become widespread and are accepted and acknowledged. Despite the opposition by interests, which profit from the high-carbon status quo, there is acceleration of change towards visible and concrete transformative low-carbon solutions for society and the economy.

Stabilization or relapse

In the stabilization phase, it is assumed that the system is fully transformed and the new pathways are embraced broadly in the society and economy. Consequently, the rhythm and speed of change decrease significantly and stabilization is observed, as people start taking the new situation for granted. However, the risk of relapse is high, if the interests of the high-carbon regime remain active and continual efforts may be needed to keep the momentum.

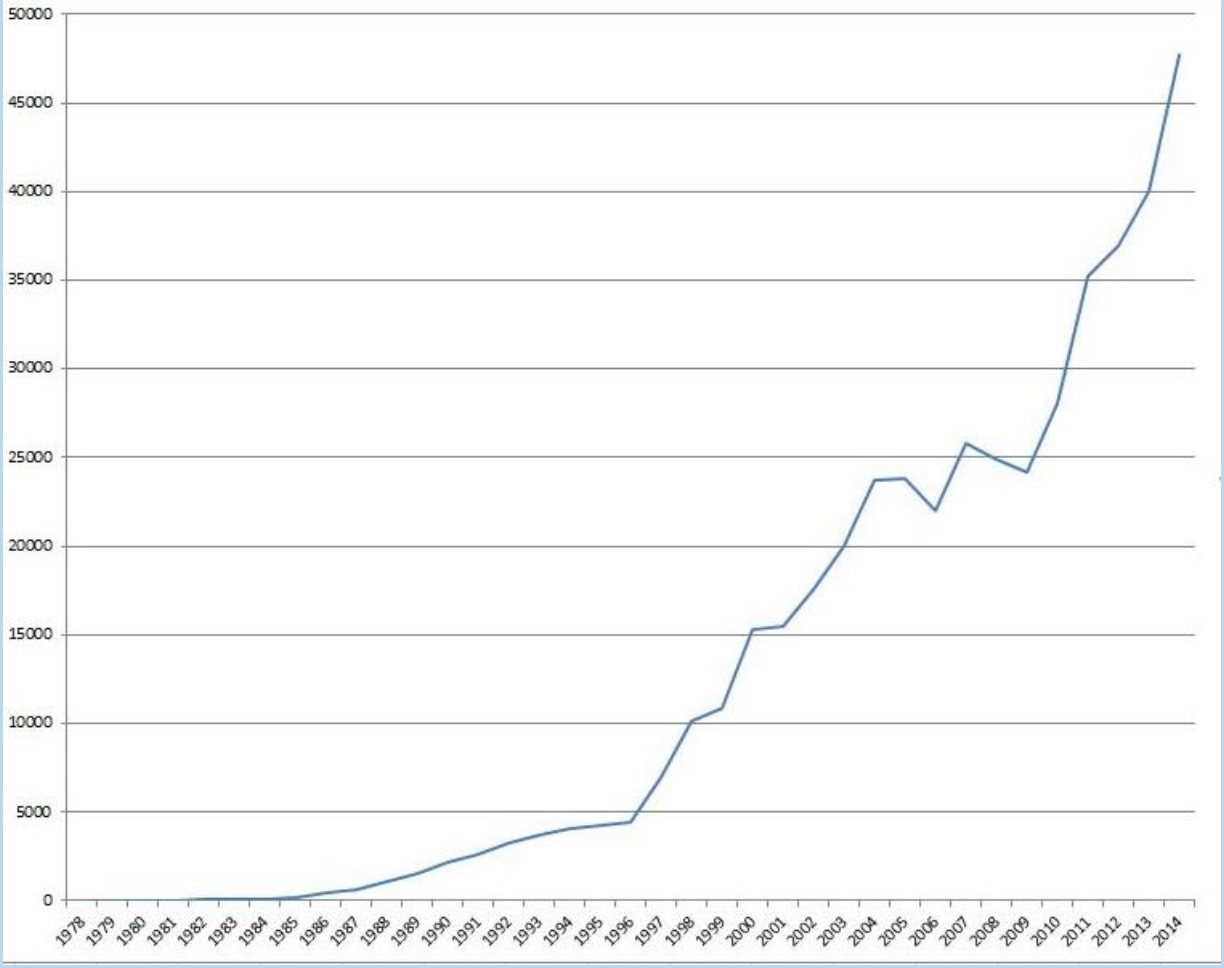
It is a *key recommendation* to identify the phase of transformation to understand the context in which the policy or action is being planned or implemented. This can help users to understand the starting situation, main barriers to transformation and context for the vision statement. Figure 6.4 can be used to identify the phase in which the system is at the starting situation. Box 6.1 illustrates various phases of transformation in a society using a case study of how wind power development in Denmark has transformed the electricity production system.

Box 6.1: Wind power development in Denmark

The story of the Danish transformation of the electricity production system begins in the *'Pre-development Phase'*. A pioneer, Poul la Cour, schoolteacher and meteorologist built the first electricity producing windmill in 1891. Prior to this wind-mills in Denmark had been used to grind flower and pump water. For many decades, the political and economic interest in electricity production from wind-mills remained low, mainly driven by pioneer and research activities.

In the 1970's the global oil-crisis was felt. Denmark's dependency on oil-producing countries, fluctuations in oil-prices and growing environmental awareness resulted in an increased interest in wind power development. Nuclear energy and renewable energy were widely debated as two alternative energy sources. An opposition movement to nuclear power grew strong, informing Danes about the risks of accidents, nuclear waste and misuse in conflict situations. In this backdrop, societal support for wind power development grew in the *'Take-off Phase'*. See the figure below.

Figure: Rise of wind power in Denmark

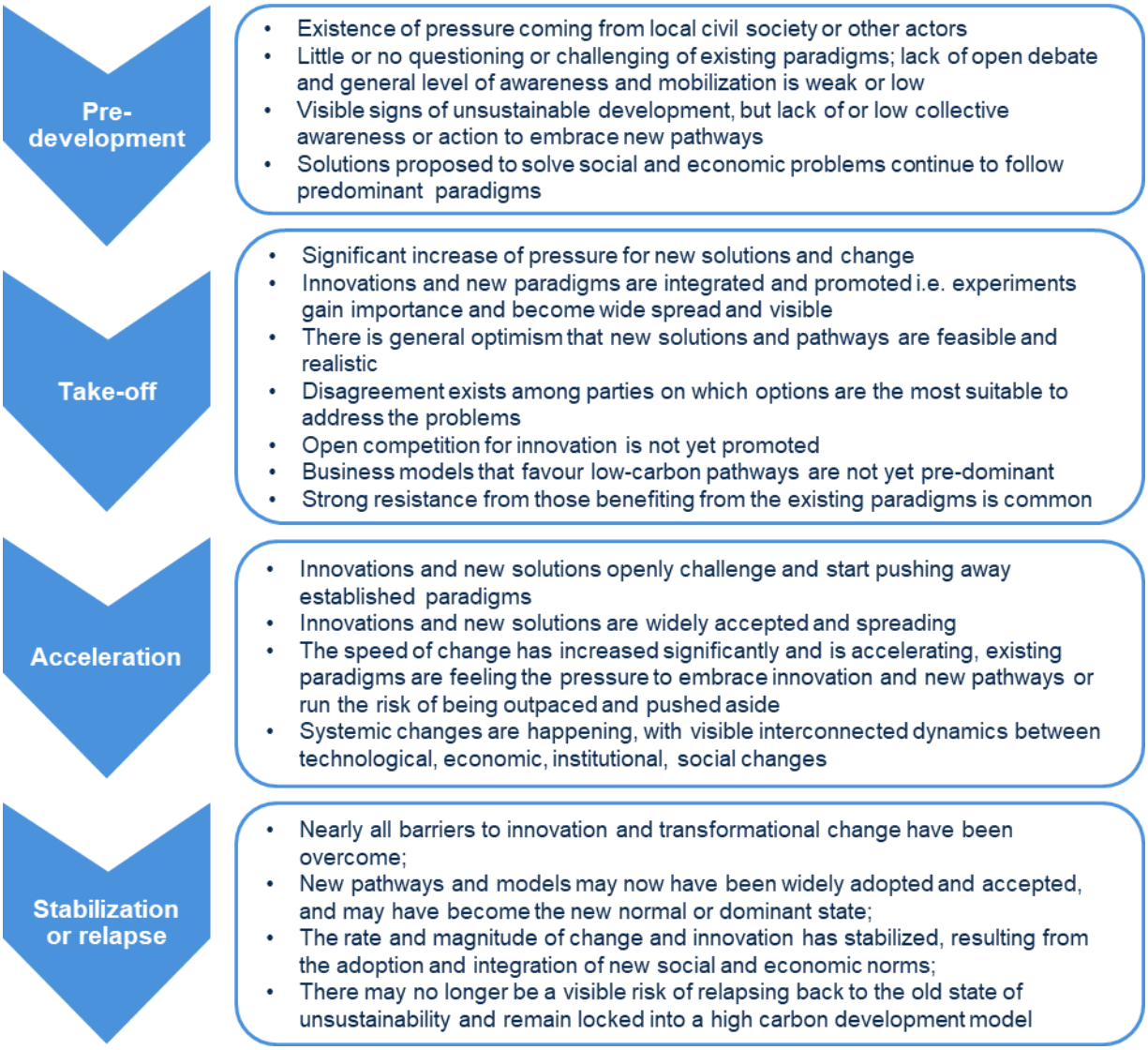


The *Acceleration Phase* for wind power development in Denmark started in the 1990's and is still ongoing. Broad societal acceptance and favorable political interest followed by legal interventions and economic subsidies characterize the acceleration phase. Wind turbines supplied 39% of the total electricity demand in Denmark in 2014. Increasingly, wind power in Denmark is replacing fossil-fuel based electricity production.

The *Stabilisation Phase* is expected to be achieved by 2050 when the Danish electricity production system is projected to become zero-carbon.

Source: Pedersen, B.G: *'Wind of change: Transformational change through wind power in Danish electricity production, moving towards 100% renewable energy by 2050'* in Olsen and Fenhann, 2015.

Figure 6.4: Criteria to identify the phase of transformation for a system

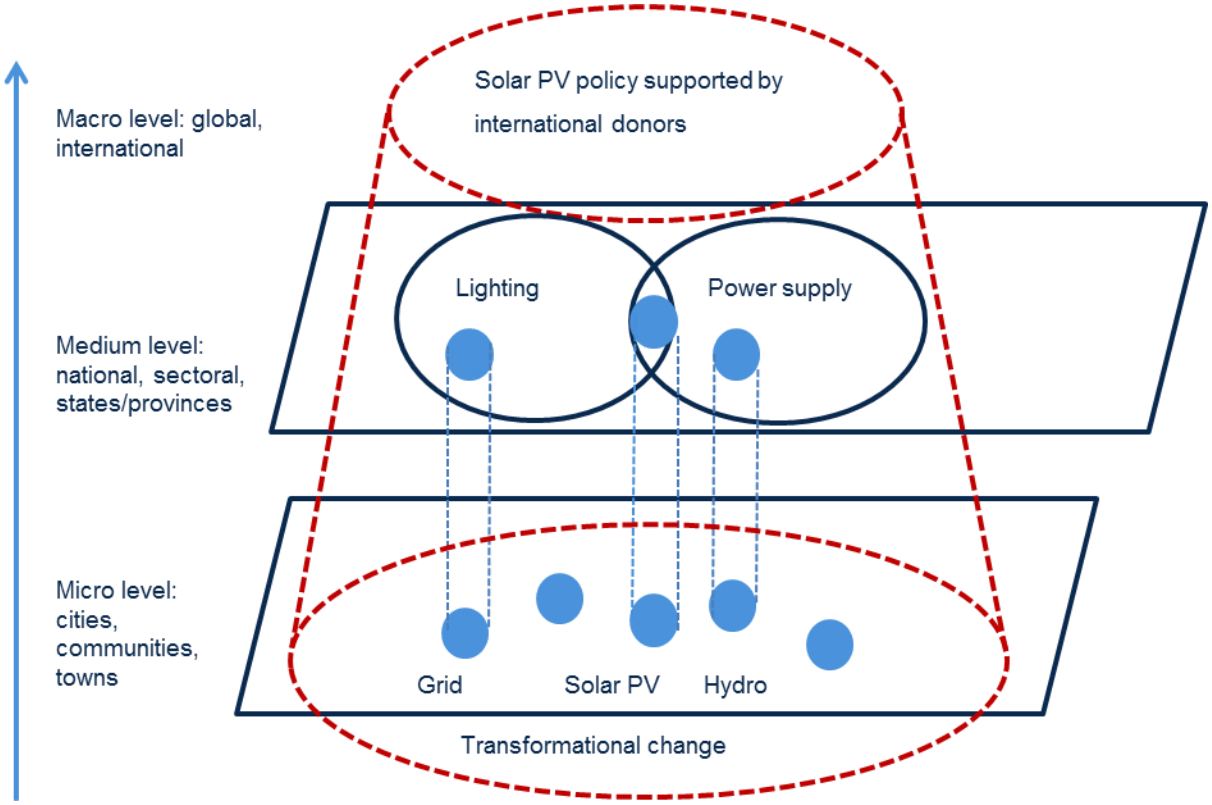


6.3 Describe the vision for transformational change of a policy or action

Transformational change can happen as a result of pressures created by people, policies or new disruptive technologies at different levels of society. Such pressures may enable a reconfiguration of existing structures, policies and practices. A policy or action can contribute to transformational change by reconfiguring high-carbon and unsustainable structures in society through intervention(s) at one or several interacting societal levels.

Figure 6.5 illustrates how the hypothetical solar PV policy contributes to changes at multiple levels. The policy supported by international donors is envisaged to create change in national policies for lighting and power supply (medium level) and in towns and local areas (micro level) by promoting solar PV systems and grid connection.

Figure 6.5: Example of how a solar PV policy interacts with society at multiple levels



Source: Adapted Geels 2004; Bodoo & Olsen 2017.

It is a *key recommendation* to describe the transformational vision of the policy or action through consultation with key stakeholders. To identify how a policy or action seeks to change society towards zero-carbon and sustainable practices, it is useful to describe the vision for transformational change over time. Users are encouraged to describe the vision for transformation as going from where the system is currently, i.e. the existing phase of transformation as identified above, to where it should be to achieve the transformational shift desired. Table 6.3 provides a template for describing the vision for transformational change. Box 5.1 provides an example from Costa Rica of describing a vision for transformational change.

The description of a vision for transformational change helps to understand the ambition of a policy or action for contributing to zero-carbon and sustainable development goals. Scale and time aspects of the changes planned are defining characteristics of transformational change. In practice, however, it cannot be determined a-priori or in hindsight within a short period of time, if the changes ongoing are truly transformational in terms of being 'locked-in', sustained and resulting in large-scale impacts. Monitoring of indicators (Chapter 10) helps to assess whether the transformational change process and outcomes are on track towards the vision. The description of a vision for transformational change can help guide the selection of the assessment boundary and assessment period in the next chapter.

Involving an inclusive network of key stakeholders (for example, 10-15 people) from all spheres of society – including those investing in a low carbon future in addition to those interested in maintaining status quo – is useful to help develop the vision and give advice on how to achieve transformational outcomes during the transition period. Stakeholders from government, companies, NGOs and knowledge providers should be invited to form a network of experts, advisors and opinion leaders. Refer to the ICAT *Stakeholder*

Participation Guide for more information on identifying and understanding stakeholders (Chapter 5) and on establishing multi-stakeholder bodies (Chapter 6).

Table 6.3: Description of the transformational change vision

Description of the vision for desired societal, environmental and technical changes	Example: Solar PV policy
Long-term (≥15 years): Describe the long-term vision for transformational change – social, environmental and technological change – including actions to be taken and impacts to be achieved in the future. Describe the vision for desired changes at different levels that are applicable in a given context – such as global, national, sectoral, provincial, cities, and communities. A vision statement is not limited to what is promised by the policy or action. Rather, it describes the future, desired context, which the policy or action contributes towards.	Contributing to the global vision of zero-carbon and sustainable development, the desired future change is to achieve zero carbon electricity production. The 2050 vision is to achieve 60% solar PV in the national electricity mix and create 2 million new green jobs. The policy, however, does not result in a significant change at the global level.
Medium-term (≥5 years and <15 years): Describe the medium-term vision for transformational change including actions to be taken and impacts to be achieved beyond the current planning cycle. Describe the vision for desired changes at different levels in terms of the development of coalitions, agendas and pathways that are planned to achieve the transformational vision.	The mid-term vision by 2030 is to achieve 30% solar PV in the national electricity mix and create a million new green jobs. In addition, the policy has set the following goals at the national/sectoral level: Annual emission reductions of 20 million tCO_2e 200,000 new green jobs (e.g., in solar PV installation and maintenance sectors)
Short-term (<5 years): Describe the short-term vision for transformational change including actions to be taken and impacts to be achieved immediately within the current planning cycle. Describe the vision for desired changes at different levels and discuss how actors, political support and investments are mobilized to implement policies and actions for achieving transformation.	The short-term vision by 2022 is to install 40 GW of rooftop solar PV and create 200,000 new green jobs in doing so. The solar PV policy is implemented at subnational levels supported by incentives for private sector involvement and knowledge development. In rural districts and towns solar PV mini-grids enable economic growth, poverty reduction and new jobs.

Box 6.2: Guiding questions and example to describe a vision for transformational change

The guiding questions are informed by the Transition Management (TM) approach (Loorbach 2010), which views transformation as a multi-level, phased process of structural change in society. Transformational change towards a shared vision is manageable through four governance activities; strategic, tactical, operational and reflexive. Transformational change cannot be steered and controlled by a single actor or intervention. Rather, processes of change can be managed through networks of actors, coordinating of actions, participatory processes of co-design and implementation, learning from experience and iterative adjustments of the vision and means to achieve it.

Guiding questions	Costa Rica example
Strategic governance:	Costa Rica has adopted a national 'Decarbonisation Plan' to achieve a net zero carbon emissions economy by 2050, in line with the objectives of the Paris Climate Change Agreement. Ten focus areas

What is the long-term (≥15 years) vision for social, environmental and technological change?	have been identified to achieve decarbonization. For each focus area a transformational vision is stated. For example, by 2050 electric power will be a primary source of energy for transport, residential, commercial and industrial services, among others (Focus Area 4)
Tactical governance: What are the structures, institutions, behaviour and values that need to change over a mid-term period (≥5 years and <15 years) to achieve the overall vision?	By 2030, the electrical grid is capable of operating at 100% with renewable energies (Focus Area 4). To track progress of NDC implementation to achieve the mid-term and long-term milestones in all focus areas in context of national sustainable development goals (SDGs), Costa Rica has set up a National Metrics System of Climate Change (SINAMECC). Assessment of sustainable development impacts of climate policies and actions help to identify benefits and negative effects in order to promote synergies and minimize trade-offs of the Decarbonisation Plan.
Operational governance: Which actions and projects within the short-term (<5 years) enable the desired change?	ICAT supports Costa Rica to develop SINAMECC for implementing the ambitious climate targets in a transparent and evidence-based manner. Costa Rica is using the ICAT Sustainable Development Methodology and the ICAT Transformational Change Methodology to lay the foundation for policies and actions that drive the transformation to a net zero carbon society and support national and global SDGs.
Reflexive governance: Do the assessment results lead to new insights and knowledge to revise and adjust the vision for transformational change?	Results of the transformational impact assessment inform the design and implementation of NDC policies and actions specific to each sector or sub-sector. Assessment insights on the processes and outcomes of change may lead to revised vision statements for sectors or sub-sectors.

Sources: Informed by Loorbach 2010, Mersmann et al. 2014, Government of Costa Rica, 2018.

6.4 Identify barriers to transformational change

Barrier analysis is important for the assessment of transformational change. If different types of barriers are not taken into account, the policy or action could be less effective than envisaged. Users that consider all relevant barriers to the policy or action are better prepared to overcome resistance and make use of opportunities that arise. An understanding of barriers helps choose relevant process characteristics in Section 6.5. It is a *key recommendation* to identify barriers to transformational change specific to the phase of transformation.

A barrier adversely affects the achievement of a target (Nygaard and Hansen, 2015). It is an obstacle to reaching the full mitigation potential of a system that can be overcome by designing and enacting measures to prevent the undesired effect (Halsnæs et al., 2007).

Barriers can either hinder desired effects, or they can lead to undesired effects. The removal of barriers can itself be a mitigation measure (the desired effect), as part of a portfolio of measures or as a single measure to support already existing measures.

Policies and actions with the objective of transforming a sector or area are likely already aiming to remove barriers to low-carbon development. Subsequently many characteristics defined in this chapter already aim to assess the extent of barrier removal. However, while doing this, other barriers may hinder the

effective removal of targeted barriers or will, even if some barriers are removed, still impede effective low-carbon development. A careful and comprehensive barrier analysis is therefore essential to achieve any change, including transformational change. Stakeholders can help to identify barriers. For information on designing and conducting consultations refer to the ICAT *Stakeholder Participation Guide* (Chapter 8).

There are different ways to categorize barriers. Categorization can help to ensure all relevant issues are covered by the analysis. Users should consider the following:

- **Political barriers:** Opposition to change due to ideological, financial or other interests; the lack of commitment to find solutions to the challenges of climate change; power struggles between the losers and winners of transformational change.
- **Institutional barriers:** Prevalence of institutions that help maintain status quo; resistance to new institutional arrangements; lack of risk-cover instruments; existence of counterproductive subsidies or import regulation; non-existent, unclear, complicated or conflicting policies and regulations (e.g., making permitting procedures lengthy and expensive); insufficient communication among different institutions.
- **Social barriers:** Reluctance to accept the introduction of low-carbon technologies especially when replacing conventional technologies; lack of social trust in equitable distribution of benefits from mitigation projects.
- **Technology barriers:** Dependence on import of low-carbon technologies; lack of domestic production facilities or alternately, insistence on domestic sourcing of technology; low quality of available technology; unavailability of equipment for production and maintenance.
- **Capacity constraints:** Lack of trained personnel for production, installation and maintenance of low-carbon technologies, policies and practices; lack of trained personnel for development of own technology; lack of information on available options; lack of capacity to design and operate sustainable financial frameworks; absence of or insufficiently resourced institutions (e.g., for regulation, data collection or enforcement.
- **Financial constraints:** Lack of financing availability or high cost for financing low-carbon technologies; lack of risk-cover instruments; existence of counterproductive subsidies or import regulation.

Users should describe the barriers relevant for the policy or action considering the five categories above and identify the characteristics affected. A single barrier may impact several characteristics and a single characteristic may be affected by several barriers. Table 6.4 provides an example of identifying barriers for the hypothetical solar PV policy.

Table 6.4: Template for describing identified barriers and affected characteristics - using solar PV policy example

Barriers	Explanation	Characteristics affected	Barrier directly targeted by the policy or action
Lack of popular support and political will to promote a transition	Vested interests in existing coal and oil dependent production actively resist climate policies and regulations. The scale of subsidies to fossil fuels is more significant than those to renewables, and political power is held by those with strong interests in maintaining current subsidy levels.	Economic and non-economic incentives	Yes
Lack of a strategy to discourage fossil fuel based energy	Existing or foreseeable energy strategy dominantly envisages expansion of coal-fired generation capacity and only limited expansion of solar PV. There is a lack of a comprehensive strategy that integrates renewable resources.	Institutional and regulatory changes	No
Limited availability of PV technology	There is very little manufacturing capacity for solar PV components in the country so components need to be imported. Lack of a strong domestic manufacturing industry negatively affects the scale-up of solar PV within the country as it keeps the costs high due to dependence on imports.	Scale up	No
Lack of technical personnel for installation and maintenance	Lack of trained technicians for solar PV installation and maintenance slows down a potential scale-up of PV technology.	Scale up	No
High upfront financial investment needed for solar PV	Lack of financial instruments to support customers in financing solar PV impedes the growth of private market and entrepreneurs in this field.	Entrepreneurs	Yes

6.5 Choose transformational change characteristics to be assessed

The section explains how to choose transformational change characteristics to be assessed in greater detail in subsequent steps. It also explains how to describe process and outcome characteristics specifically for the policy or action.

The relevance of process characteristics is determined based on the objectives of the assessment, national circumstances, phase of transformation, barriers and stakeholder priorities. It is a *key recommendation* to choose process characteristics to be assessed based on their relevance to transformational change in the context of the policy or action and the society in which it is implemented. It

is also a *key recommendation* to describe outcome and process characteristics relevant for the policy or action.

Characteristics are classified as *relevant*, *possibly relevant*, or *not relevant* as shown in Table 6.5.

For example, if the solar PV policy is implemented in a country where awareness of solar solutions is not a limiting factor to scaling up solar, the 'awareness characteristic' can be considered 'not relevant' in the assessment. However, where lack of awareness is one of the reasons for slow uptake of solar, this process characteristic should be considered 'relevant', irrespective of whether the policy is directed at improving awareness. While all solar policies are not expected to address every aspect of the sector, a transformational policy is expected to consider how and when to influence relevant process characteristics to bring about systemic, lasting change. Further, the policy need not directly address all relevant process characteristics through various measures but may envisage an indirect impact over time (e.g., subsidies lead to increased penetration of solar technologies, which in turn enhances awareness). This broader interpretation of relevance ensures that changes related to process characteristics critical for transformational change in the given context are regularly monitored.

Process characteristics classified as *relevant* and *possibly relevant* are assessed in subsequent steps.

Table 6.5: Determining the relevance of process characteristics

Relevance	Description
Relevant	Reason to believe that a characteristic is important for transformational change in the given context of the policy or action
Possibly relevant	It is not clear whether the characteristic is important for transformational change in the given context of the policy or action. Where the relevance is unknown or cannot be determined the characteristic should be monitored over time
Not relevant	Reason to believe that the characteristic is not important for transformational change in the given context of the policy or action

Relevant process characteristics are identified by seeking a wide range of stakeholder opinions and priorities. The ICAT *Stakeholder Participation Guide* (Chapter 8) provides information on designing and conducting consultations.

The relevance of process characteristics can vary over time due to changes in underlying conditions and circumstances. Users may find that process characteristics described as *possibly relevant* or *not relevant* become relevant over time, or some process characteristics are no longer relevant. Therefore, users are encouraged to revisit the relevance of process characteristics regularly during the monitoring phase. In doing so, users should revisit Table 6.6 and update it at regular intervals as per the monitoring plan described in Chapter 10. Users can also choose to monitor process characteristics classified as *not relevant* in less detail. This can involve expert judgment, literature review, proxy data or stakeholder inputs to record any changes in these characteristics.

Users should describe all characteristics of outcomes and processes relevant for the policy or action. It is important to clearly describe characteristics in a manner so that these are mutually exclusive and collectively comprehensive, while recognizing that they are interrelated. This will avoid duplication and overlaps between different characteristics and will ensure that a particular effect is not considered multiple times during the assessment.

Table 6.6 provides a template to describe which process characteristics are selected as relevant or possibly relevant for detailed analysis in subsequent steps of impact assessment and to justify the choice. In providing this justification, users can describe the existing context and prevailing hindering factors that make a characteristic relevant or not relevant. For completeness, transparency and reflection on ambition, users should provide rationale and justification for the choice of process characteristics included or excluded from the assessment.

Table 6.7 provides a template to describe outcome characteristics. Users should describe outcome characteristics for GHG and selected sustainable development impacts separately to be able to assess each one individually.

Users should include all relevant transformational impacts in the assessment boundary and the assessment period. Outcome or process characteristics referring to levels or time periods that are outside the assessment boundary or period should not be included. However, to ensure a comprehensive approach for the assessment of all transformational impacts relevant to the policy or action, users should revisit and update the definition of the assessment boundaries in Section 5.3 as needed.

Table 6.6: Template for choosing process characteristics relevant to a policy or action – illustrated for the solar PV policy example

Category	Process Characteristic	Description of characteristic – specific to a policy or action	Relevant/ Possibly relevant/ Not relevant Provide justification
Technology	Research and development (R&D)	No description necessary, since this characteristic is not relevant	Not relevant Solar R&D is not lacking in investment and is not considered an area that is holding back solar PV in the country.
	Adoption	The policy leads to early adoption of solar grid rooftop among residential and commercial consumers.	Relevant Adoption rate for solar grid rooftop is quite low across the country and needs targeted interventions. High capital cost of rooftop systems and longer pay back periods have discouraged its widespread adoption by small consumers in residential and commercial sectors.
	Scale up	The policy leads to large scale deployment of solar PV rooftop installations as new business models emerge for service and delivery to capitalize on the policy incentives and preferential tariff.	Relevant Several barriers exist to large scale deployment of rooftop PV. Solar rooftop has a negligible share in the solar energy sector. There is a huge amount of untapped potential in the solar rich country. Several barriers exist to large scale deployment of rooftop PV (e.g., lack of manufacturing facilities and high skilled workforce, high upfront cost).
Agents	Entrepreneurs	The policy directly engages entrepreneurs, businesses and investors through financial subsidy and feed-in tariff.	Relevant These are some of the most important change agents for the solar PV policy in the country. There is acknowledgement that solar sector should be able to attract private investment and lending to sustain interest from businesses and entrepreneurs and continue to grow. The

			government has also commissioned a study on how to create an attractive financial environment to attract large scale investment in the sector.
	Coalitions of advocates	The policy indirectly provides a fertile ground for coalitions and networks of stakeholders to engage towards a common goal of increased solar uptake.	Possibly relevant It is not clear whether this is an important constituency to catalyze transformational change in solar PV in the country. Business associations and think tanks are active in convening stakeholders and policymakers and providing a forum to discuss issues related to renewable energy.
	Beneficiaries	No description necessary since this characteristic is not relevant.	Not relevant The political context in the country makes beneficiaries an ineffective group that plays no role in scale-up.
Incentives	Economic and non-economic	The policy utilizes financial incentives to catalyze growth in the solar sector.	Relevant Financial subsidy and feed-in tariff are key ways to increase technology penetration and promote grid-connected solar rooftop uptake. Other economic and non-economic incentives exist to encourage uptake of off-grid solar and large solar power plants, as well as other forms of renewable energy (e.g., wind and biomass).
	Disincentives	The policy does not employ disincentives for carbon-intensive energy generation.	Possibly relevant The assessment is limited to the solar PV sector and it is not clear whether disincentives applied to fossil fuels will be strong enough to cause any impact in the solar PV sector.
	Institutional and regulatory	The policy leads to the formation of new agencies, institutions, and regulations at subnational level.	Relevant Development of new agencies is needed at sub-national levels to further promote solar in states. While there is a dedicated agency at the national level to promote renewable energy, there is no such counterpart in states and a robust institutional set up to design and implement measures and build capacity at all levels does not exist yet.
Norms	Awareness	No description necessary since this characteristic is not relevant	Not relevant There is a high level of awareness in the country and this is not considered a hindering factor.
	Behaviour	The solar PV policy affects the behaviour of residential and commercial consumers to opt for solar PV.	Relevant Awareness has not led to change in behavior possibly due to factors related to financing and upfront costs and it is in an area that needs more attention.
	Social norms	The solar PV policy may have an influence on societal	Possibly relevant Societal norms favor less carbon intensive lifestyle in general and it is not clear whether

	attitudes in favour of rooftop PV technologies.	norms are holding back solar PV. There is a greater push for green, clean living in urban centers as pollution increases and environmental resources are depleted.

Table 6.7: Template for describing outcome characteristics for a policy or action – illustrated for the solar PV policy example

Category	Outcome characteristic	Description – specific to a policy or action, including status at the beginning of the assessment period
Scale of outcome – GHGs	Macro level: GHG outcome is large in magnitude at international/global level	This level is outside the assessment boundary. No description necessary.
	Medium level: GHG outcome is large in magnitude at national or sectoral levels	The policy has set a goal of annual emission reductions of 20 million $tCOR_2Re$ nationally. Solar PV has a 5% share in the national electricity mix in 2016.
	Micro level: GHG outcome is large in magnitude at subnational, subsector, city or local levels	The solar PV policy is implemented at subnational levels supported by incentives for private sector involvement and knowledge development. In two Northern rural provinces of the country solar PV contributes 20% of the electricity mix in 2016.
Scale of outcome – Sustainable development	Macro level: Sustainable development outcome is net positive in magnitude at international/global level	This level is outside the assessment boundary. No description necessary.
	Medium level: Sustainable development outcome is net positive in magnitude at national or sectoral levels	Solar PV policy aims to create 200,000 new green jobs in the sector (e.g., in solar PV installation and maintenance) by 2022 and up to 2 million new jobs by 2050. There are currently 10,000 jobs in the solar PV sector nationally.
	Micro level: Sustainable development outcome is net positive in magnitude at subnational, subsector, city or local levels	In rural districts and towns new jobs are created through installation and operation of solar PV mini-grids. In the two Northern provinces there are about 600 jobs each in the solar PV industry.
Outcome sustained over time – GHGs	Long term: GHG outcome is achieved and sustained ≥15 years from the starting situation	The period is longer than the assessment period. No description necessary.
	Medium term: GHG outcome is achieved and sustained ≥5 years and <15 years from the starting situation	Solar PV policy aims to achieve its mid-term (2030) vision of 30% solar PV in the national electricity mix, and sustain the trend of growing share of solar PV in the country. Currently solar PV has 5% share in national electricity mix. It is a new policy and enough time has not passed to

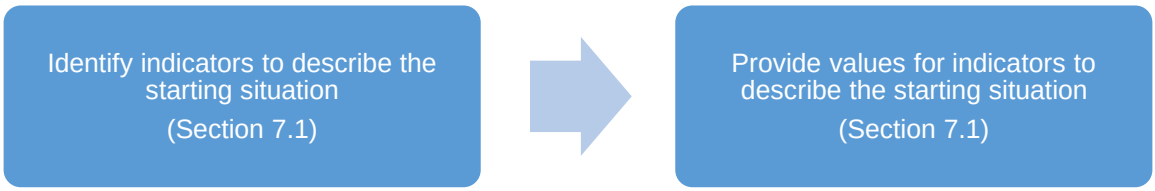
		clearly show that the policy impacts are sustained.
	Short-term: GHG outcome is achieved and sustained <5 years from the starting situation	The policy is targeting to install 40 GW of rooftop solar PV by 2022 and trigger increased emission reductions over the assessment period. There are no clear indications so far that the policy impacts are going to be sustained.
Outcome sustained over time – Sustainable development	Long term: Sustainable development outcome is achieved and sustained ≥15 years from the starting situation	The period is longer than the assessment period. No description necessary.
	Medium term: Sustainable development outcome is achieved and sustained ≥5 years and <15 years from the starting situation	The solar PV policy aims to achieve its mid-term (2030) vision of a million new green jobs and sustain the trend of increasing jobs in the country. It is too early to see signs of sustained job growth.
	Short-term: Sustainable development outcome is achieved and sustained <5 years from the starting situation	The solar PV policy aims to achieve its short-term goal of 200,000 new green jobs in solar PV installation and maintenance sectors. There is no evidence yet that the policy's impact on jobs is sustained though it is expected to show an upward trend with rise in share of solar PV.

PART III: IMPACT ASSESSMENT

7. ASSESSMENT OF THE STARTING SITUATION

This chapter provides the methodology to assess the starting situation for transformational change. The starting situation describes the state of the system and the status of the transformational change characteristics at the beginning of the assessment period. Assessment of the starting situation is useful to understand the extent to which a policy or action triggers a shift away from carbon intensive and unsustainable pathways. The starting situation can refer to a historical year of reference in the case of ex-post assessment or the current year (or the most recent year for which data is available) in the case of ex-ante assessment.

Figure 7.1: Overview of steps in Chapter 7



Checklist of key recommendations

- Identify indicators to describe the starting situation of characteristics impacted by the policy or action and provide indicator values

7.1 Describe the starting situation of relevant characteristics

The starting situation helps with the understanding of the status of the system and relevant characteristics to assess change against. It can provide useful insights into the existing barriers at the phase of transformation in which the policy or action operates. It is a *key recommendation* to identify indicators to describe the starting situation of characteristics impacted by the policy or action.

The indicators for characteristics considered *relevant* or *possibly relevant* in Section 6.5 are identified in this step. Indicators of outcome and process characteristics are useful to assess specific aspects of system change and can be monitored over time to track progress. Examples of qualitative and quantitative indicators are available in Appendix A.

Indicators are important to assess how the policy or action is leading to a system change that is fundamental, disruptive and sustained. Users should consult stakeholders in selecting key indicators, and when and how frequently to monitor them. Policies may directly impact only select characteristics though for transformational policies it is expected that they will have an indirect impact on several relevant process characteristics. For example, a measure focused on influencing behavior change towards products with zero or low carbon footprint may indirectly trigger a technological change in response to increased demand for such products. Users are encouraged to look beyond the expected impact to analyze how policies may indirectly affect a wide range of relevant process characteristics. Some of these may be outside the immediate scope of the policy and proxy indicators may be identified to monitor effects, for example, technology change can be observed through number of scientific articles published and patent applications. A well documented notion in the literature is the use of SMART indicators; that is,

indicators that are Specific, Measurable, Achievable, Realistic and Time-bound. The challenge for transformational change is identifying "SSSMART" indicators that also capture the *scale* and *sustained nature* of impacts resulting from the policy or action.

For example, the idea of scale can be captured both horizontally (e.g., innovation spreading across sectors or a greater number of people applying solar PV technology), and vertically (e.g., an incentive program at city level is adopted at regional or national level). The same indicators used to assess the starting situation can then be projected for ex-ante assessment and observed for ex-post assessment to assess transformational change. Further information on selection of indicators is provided in Chapter 10.

Users can select indicators for process and outcome characteristics to help describe the starting situation of relevant characteristics impacted by the policy or action. Table 7.1 and Table 7.2 provide a template and an example using the hypothetical solar PV policy for how to use indicators to describe the starting situation of selected process and outcome characteristics. The indicators given here are just illustrative and not meant to provide a comprehensive list for assessing the solar PV policy. These tables build on the information generated in the earlier step which is represented in grey columns. The tables will be further built on as users complete subsequent steps.

Table 7.1: Template for description of the starting situation for selected process characteristics – hypothetical solar PV example

Process category	Process characteristic	Description – specific to a policy or action	Indicators	Indicator value at starting situation (2016 – for solar PV example)
Technology	Research and development	Not relevant Solar R&D is not lacking in investment and is not considered an area that is holding back solar PV in the country	Users can choose to monitor indicators for 'not relevant' characteristics, if desired	NA
	Adoption	Relevant. Adoption rate for solar grid rooftop is quite low across the country and needs targeted interventions. High capital cost of rooftop systems and longer pay back periods have discouraged its widespread adoption by small consumers in residential and commercial sectors.	Number of new demonstration projects for solar rooftop PV initiated	None
	Scale-up	Relevant. Several barriers exist to large scale deployment of rooftop PV. Solar rooftop has a negligible share in the solar energy sector. There is a huge amount of untapped potential in the solar rich country. Several barriers exist to large scale	Share of installed PV rooftop in the solar sector (nationwide or statewide)	5%

		deployment of rooftop PV (e.g., lack of manufacturing facilities and high skilled workforce, high upfront cost)		
Agents	Entrepreneurs	Relevant. These are some of the most important change agents for the solar PV policy in the country. There is acknowledgement that solar sector should be able to attract private investment and lending to sustain interest from businesses and entrepreneurs and continue to grow. The government has commissioned a study on how to create an attractive financial environment to attract large scale investment in the sector.	Volume of venture capital investments	USD 100 million
	Coalitions of advocates	Possibly relevant. It is not clear whether this is an important constituency to catalyze transformational change in solar PV in the country. Business associations and think tanks are active in convening stakeholders and policymakers and providing a forum to discuss issues related to renewable energy.	Number of projects/research centers involving university-industry collaboration	1
	Beneficiaries	Not relevant The political context in the country makes beneficiaries an ineffective group that plays no role in scale-up.	Users can choose to monitor indicators for 'not relevant' characteristics, if desired	NA
Incentives	Economic and non-economic incentives	Relevant. Financial subsidy and feed-in tariff are key ways to increase technology penetration and promote grid-connected solar rooftop uptake. Other economic and non-economic incentives exist to encourage uptake of off-grid solar and large solar power plants, as well as other forms of renewable energy (e.g., wind and biomass)	Number of new economic incentives in place for grid rooftop solar	1

	Disincentives	Possibly relevant. The assessment is limited to the solar PV sector and it is not clear whether disincentives applied to fossil fuels will be strong enough to cause any impact in the solar PV sector.	Number of new disincentives to discourage fossil fuels to generate electricity	1
	Institutional and regulatory	Relevant. Development of new agencies is needed at sub-national levels to further promote solar in states. While there is a dedicated agency at the national level to promote renewable energy, there is no such counterpart in states and a robust institutional set up to design and implement measures and build capacity at all levels does not exist yet.	Number of new regulations and institutions set up to promote solar	3
Norms	Awareness	Not relevant. There is a high level of awareness in the country and this is not considered a hindering factor.	Users can choose to monitor 'not relevant' characteristics if desired	NA
	Behaviour	Relevant. Awareness has not led to change in behavior possibly due to factors related to financing and upfront costs and it is in an area that needs more attention.	Number of new measures to influence consumer behaviour in favour of solar/ renewable energy	None
	Social norms	Possibly relevant. Societal norms favor less carbon intensive lifestyle in general and it is not clear whether norms are holding back solar PV. There is a greater push for green, clean living in urban centers as pollution increases and environmental resources are depleted.	Number of emerging leaders/role models (e.g., states leading the transition to renewable energy) favoring renewables	None

Table 7.2: Template for description of the starting situation for selected outcome characteristics – hypothetical solar PV example

Outcome category	Outcome characteristic	Description of the starting situation (same as the	Indicators	Indicator value at starting situation (2016

		Description column in Table 6.7)		- for solar PV example)
Scale of outcome – GHGs	Global or international level (macro level)	This level is outside the assessment boundary. No description necessary.	Users can choose to monitor characteristics outside the assessment boundary if desired	NA
	National or sectoral level (medium level)	The policy has set a goal of annual emission reductions of 20 million $tCOR_2Re$ nationally. Solar PV has a 5% share in the national electricity mix in 2016.	Installed capacity of grid-connected solar rooftop power plants (up to 500 KW) at a national level	1 GW
	Subnational level (micro level)	The solar PV policy is implemented at subnational levels supported by incentives for private sector involvement and knowledge development. In two Northern rural provinces of the country solar PV contributes 20% of the electricity mix in 2016.	Installed capacity of grid-connected solar rooftop power plants (up to 500 KW) at a subnational level (state level average capacity)	100 MW
Scale of outcome – Sustainable development	Global or international level (macro level)	This level is outside the assessment boundary. No description necessary.	Users can choose to monitor characteristics outside the assessment boundary if desired	NA
	National or sectoral level (medium level)	Solar PV policy aims to create 200,000 new green jobs in the sector (e.g., in solar PV installation and maintenance) by 2022 and up to 2 million new jobs by 2050. There are currently 10,000 jobs in the solar PV sector nationally.	Employment generation in solar sector at a national level	10,000
	Subnational level (micro level)	In rural districts and towns new jobs are created through installation and operation of solar PV mini-grids. In the two Northern provinces there are about 600	Employment generation in solar sector in province X	600

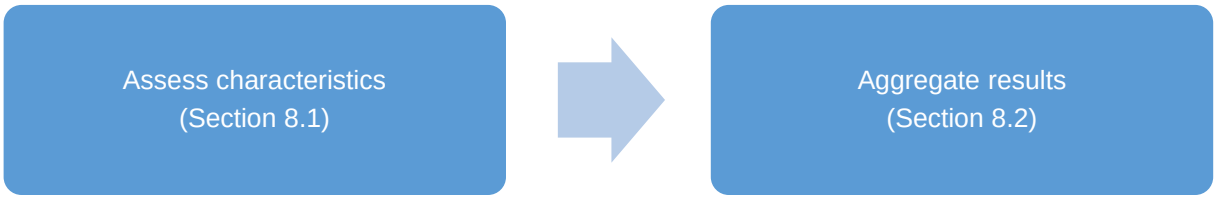
		jobs each in the solar PV industry.		
Outcome sustained over time - GHG	Long-term: (≥15 years from the starting situation)	The period is longer than the assessment period. No description necessary.	Users can choose to monitor characteristics outside the assessment period if desired	NA
	Medium term: (≥5 years and <15 years from the starting situation)	Solar PV policy aims to achieve its mid-term (2030) vision of 30% solar PV in the national electricity mix, and sustain the trend of growing share of solar PV in the country. Currently, solar PV has 5% share in national electricity mix. It is a new policy and enough time has not passed to clearly show that the policy impacts are sustained..	Trend in installed capacity of grid-connected solar rooftop power plants (up to 500 KW)	NA
	Short term: (0<5 years from the starting situation)	The policy is targeting to install 40 GW of rooftop solar PV by 2022 and trigger increased emission reductions over the assessment period. There are no clear indications so far that policy impacts are going to be sustained.	Trend in installed capacity of grid-connected solar rooftop power plants (up to 500 KW)	NA
Outcome sustained over time - Sustainable development	Long-term: (≥15 years from the starting situation)	The period is longer than the assessment period. No description necessary.	Users can choose to monitor characteristics outside the assessment period if desired	NA
	Medium term: (≥5 years and <15 years from the starting situation)	The solar PV policy aims to achieve its mid-term (2030) vision of a million new green jobs and sustain the trend of increasing jobs in the country. It is too early to see signs of sustained job growth.	Trend in employment generation in solar sector	NA
	Short term:	The solar PV policy aims to achieve its short-term goal of	Trend in employment generation in solar sector	NA

	(0<5 years from the starting situation)	200,000 new green jobs in solar PV installation and maintenance sectors. There is no evidence yet that the policy's impact on jobs is sustained though it is expected to show an upward trend with rise in share of solar PV.		

8. Estimating Transformational Impacts Ex-ante

This chapter introduces the steps for conducting an ex-ante assessment of policies or actions to understand the extent of transformation expected in the future. These include assessing the expected impacts for transformational change through assessment of characteristics in a qualitative way over the assessment period, while considering potential barriers, and aggregating the results of the assessment. This chapter describes a qualitative approach to assessing transformational impacts ex-ante and compiling the assessment towards an overall assessment.

Figure 8.1: Overview of steps in Chapter 8



Checklist of key recommendations

- Assess and qualitatively score each characteristic using the scale provided in Table 8.3 and explain the underlying assessment
- Aggregate the results for all characteristics and barriers to the process and outcome level

8.1 Assess characteristics

A forward-looking assessment of outcome and process characteristics is a key step to understand the extent of transformation expected. It is a *key recommendation* to qualitatively assess each characteristic and to explain the underlying assessment of process and outcome characteristics. Table 8.1 provides a scale for qualitatively assessing each characteristic. Different scales are used to assess process and outcome characteristics. Table 8.2 and Table 8.3 provide templates for explaining the assessment of process and outcome characteristics.

Ex-ante assessment of transformational change is a qualitative analysis based on the comparison of starting situation and expected development over the assessment period. Users can estimate future quantitative or qualitative values for selected indicators and compare these with corresponding values for the starting situation (as described in Section 7.1) to assess the extent of transformation expected.

Appendix A provides examples of indicators for process and outcome characteristics. For outcome characteristics, indicators related to GHG and sustainable development impacts can be quantified using the ICAT methodology for greenhouse gas impacts and sustainable development impacts.

Table 8.1: Scale for scoring characteristics

Scale[8]	Description of scale
Process characteristics	
4	It is very likely that the policy or action will have a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 90-100%)
3	It is likely that the policy or action will have a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 66-90%)
2	It is possible that the policy or action will have a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 33-66%). Instances where the likelihood is unknown or cannot be determined should be considered possible.
1	It is unlikely that the policy or action will have a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 10-33%)
0	It is very unlikely that the policy or action will have a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 0-10%)
Outcome characteristics – scale (for GHG impacts and sustainable development impacts)	
3	The policy or action results in GHG impacts that relative to the starting situation represent large emission reductions at the level of assessment targeted The policy or action results in sustainable development impacts that relative to the starting situation represent net positive large impacts at the level of assessment targeted
2	The policy or action results in GHG impacts that relative to the starting situation represent moderate emissions reductions at the level of assessment targeted The policy or action results in sustainable development impacts that relative to the starting situation represent net positive moderate impacts at the level of assessment targeted
1	The policy or action results in GHG impacts that relative to the starting situation represent minor emission reductions at the level of assessment targeted The policy or action results in sustainable development impacts that relative to the starting situation represent net positive minor impacts at the level of assessment targeted
0	The policy or action does not result in GHG impacts relative to the starting situation at the level of assessment targeted The policy or action does not result in sustainable development impacts relative to the starting situation at the level of assessment targeted
-1	The policy or action results in GHG impacts that relative to the starting situation represent a net increase in emissions at the level of assessment targeted The policy or action results in sustainable development impacts that relative to the starting situation represent net negative impacts at the level of assessment targeted

[8] The scale uses numbers as a simple reference to qualitative scores explained in this table. When aggregating across characteristics, the number scores should not be used in a numerical way, for example, they should not be averaged to obtain category-level scores.

Outcome characteristics – sustained over time (for GHG impacts and sustainable development impacts)	
4	The policy or action results in GHG impacts that are very likely to be sustained over the assessment period (for example, a probability in the range of 90-100%) The policy or action results in sustainable development impacts that are very likely to be sustained over the assessment period (for example, a probability in the range of 90-100%)
3	The policy or action results in GHG impacts that are likely to be sustained within the assessment period (for example, a probability in the range of 66-90%) The policy or action results in sustainable development impacts that are likely to be sustained within the assessment period (for example, a probability in the range of 66-90%)
2	The policy or action results in GHG impacts that are possibly sustained within the assessment period (for example, a probability in the range of 33-66%). Instances where the likelihood is unknown or cannot be determined should be considered possible. The policy or action results in sustainable development impacts that are possibly sustained within the assessment period (for example, a probability in the range of 33-66%). Instances where the likelihood is unknown or cannot be determined should be considered possible.
1	The policy or action results in GHG impacts that are less likely to be sustained over the assessment period (for example, a probability in the range of 10-33%) The policy or action results in sustainable development impacts that are less likely to be sustained over the assessment period (for example, a probability in the range of 10-33%)
0	The policy or action results in GHG impacts that are unlikely to be sustained over the assessment period and risk being reversed to negative impacts (for example, a probability in the range of 0-10%) The policy or action results in sustainable development impacts that are unlikely to be sustained over the assessment period and risk being reversed to negative impacts (for example, a probability in the range of 0-10%)

It is important to consider the overall level of ambition (described in Chapter 3), vision of transformational change (described in Chapter 5) and barriers while scoring individual characteristics. This is the aspiration against which individual characteristics are assessed while considering potential barriers. When scoring, the question is to what extent the policy or action can realistically be expected to achieve the desired transformation described by a characteristic within the assessment boundary and assessment period defined by the user. A policy is more likely to impact any given characteristic, if the characteristic represents a key element of the policy and the policy includes measures to address existing barriers. Impacts that are expected to happen after the assessment period can be captured by conducting a subsequent analysis covering the relevant period.

The qualitative assessment of expected future developments is challenging and can be subjective. Therefore, a transparent, inclusive process for conducting the assessment describing individual steps and providing an explicit rationale for decisions is essential to ensure the robustness of results. To support the qualitative assessment of characteristics and inform the scoring, we encourage users to utilize qualitative and quantitative indicators provided in Appendix A and discussed in Chapter 10. It can be helpful to collect data on the current value of selected indicators and assess expected future values of these to arrive at the qualitative assessment of characteristics. It may not be necessary to collect information on all indicators required for ex-post assessment and monitoring, particularly when the objective of analysis is

to decide between different measures. It is, however, important to note that starting with data collection at an early stage of implementation will improve the ability to monitor and evaluate at later stages.

To minimize subjectivity and bias further, it is advisable to involve a wide range of stakeholders and experts in the exercise. A multi-stakeholder process to assess the individual characteristics adds further value by allowing an in-depth discussion which can lead to fruitful and effective improvements in the design of policies and measures. The ICAT *Stakeholder Participation Guide* provides information on identifying and understanding stakeholders (Chapter 5) and establishing multi-stakeholder bodies (Chapter 6).

Table 8.2: Template for describing the ex-ante assessment of process characteristics – solar PV policy example[9]

Category	Characteristic	Score	Rationale justifying the score	Indicators	Indicator value at starting situation (2017)	Indicator value for expected transformation (2030)
Technology	Research and development	NA	Not relevant	NA	NA	NA
	Adoption	3	The financial subsidy and feed-in tariff have been widely used to increase adoption of clean technology across the world, and a similar result can be realistically expected in this case too. These incentives are likely to kick start the local industry thus addressing the barrier of a weak domestic solar industry.	Number of demonstration projects for solar rooftop PV initiated (annual)	None	10
	Scale up	3	Financial subsidy and feed-in tariff have been widely used to scale up clean technology across the world. Together, these will address the barrier of high upfront financial investment needed for solar PV and improve the payback period on solar. It is realistically expected that these will lead to a significant uptake of solar in the country over the assessment period while addressing the barrier of limited availability of both technology and skilled workforce for installation and maintenance by kick	Share of solar PV rooftop generation in the solar sector (nationwide or statewide	5%	30%

[9] The table builds on the information generated in the earlier step which is represented in grey columns.

			starting the local manufacturing and service industry.			
Agents	Entrepreneurs	3	The policy is likely to influence entrepreneurs and investors to invest in solar-related businesses and capitalize on the financial incentives available. High upfront financial investment is a significant barrier in the country that is currently preventing businesses and entrepreneurs from investing in solar technology.	Volume of venture capital investments	USD 100 million	USD 1 billion
	Coalition of advocates	2	Solar PV policy is likely to indirectly support the creation of coalitions and networks.	Number of projects/research centers involving university-industry collaboration	1	10
	Beneficiaries	NA	Not relevant	NA	NA	NA
Incentives	Economic and non-economic incentives	3	Solar PV policy will utilize subsidies and feed-in tariff as means to increase technology penetration. It is expected that the incentives will promote consumer demand, which in turn will increase the local service industry. This will help address barriers such as lack of technical personnel for installation and maintenance, and give a boost to industry.	Number of new economic incentives in place for solar	1	5
	Disincentives	0	Solar PV policy is not likely to use disincentives as means to achieve its goals, nor does it seem realistic that disincentives will be extensively used over the assessment period to promote clean energy in the country. As identified in barriers, the country lacks a comprehensive strategy to discourage fossil fuels and it does not seem likely that there will be political will to overcome this in the foreseeable future.	Number of new disincentives to discourage fossil fuels to generate electricity	1	1
	Institutional and regulatory	2	Solar PV policy is likely to lead to the development of new agencies and	Number of new regulations and	3	10

			regulations to further promote solar in states. However, there is expected to be a time lag with some front runners leading the way, while other states gradually follow as experience builds.	institutions set up to promote solar		
Norms	Awareness	NA	Not relevant	NA	NA	NA
	Behaviour	2	Solar PV policy is likely to influence consumer behaviour and shift their preferences away from carbon intensive electricity as a result of targeted financial incentives. However, in the absence of a strategy to discourage fossil fuels as identified in barriers, there is not expected to be any widespread change in behaviour.	Number of new measures to influence consumer behaviour in favor of solar/ renewable energy	None	1
	Social norms	1	Solar PV policy is less likely to influence societal norms. However, in the absence of targeted initiatives towards this. It is expected that 1-2 states will emerge as leaders in the solar industry over the assessment period.	Number of emerging leaders/role models (e.g., states leading the transition to renewable energy) favoring renewables	None	1-2

Table 8.3: Template for describing the ex-ante assessment of outcome characteristics – solar PV policy example[10]

Category	Characteristic	Score	Rationale justifying the score	Indicators	Indicator value at starting situation (2017)	Indicator value for expected transformation (2030)
Scale of outcome-GHG	Macro level	NA	Outside the assessment boundary	NA	NA	NA
	Medium level	3	The policy aimed at national level impacts is likely to achieve its vision related to GHGs. The 2022 target and mid-term vision is ambitious.	Installed capacity of grid-connected solar rooftop power plants (up to 500 KW) at a national level	1 GW	50 GW

[10] The table builds on the information generated in the earlier step which is represented in grey columns

	Micro level	3	The policy is likely to achieve its national level targets through developing solar power in states and cities. While 1-2 states are expected to be front runners and lead in solar rooftop, others are likely to achieve moderate growth in solar over the assessment period.	Installed capacity of grid-connected solar rooftop power plants (up to 500 KW) at a subnational level (state level average capacity)	100 MW	1 GW
Scale of outcome-sustainable development	Macro level	NA	Outside the assessment boundary	NA	NA	NA
	Medium level	3	Growth is solar is expected to be accompanied by a large boost to employment in this sector.	Employment generation in solar sector at a national level	10,000	1 mn
	Micro level	2	While in some regions there is expected to be a net large positive impact on job creation, in many others the impact is likely to be moderate.	Employment generation in solar sector in province X	600	40,000
Outcome sustained over time-GHG	Long-term	NA	Outside the assessment period (2017-2030)	NA	NA	NA
	Medium-term	2	In the medium term, no reversal of impacts is expected and the gains made by the solar PV policy are likely to be sustained over the assessment period.	Trend in installed capacity of grid-connected solar rooftop power plants (up to 500 KW)	NA	Sustained growth expected from 2022 - 2030
	Short-term	3	In the short-term too, no reversal of impacts is expected and the gains achieved are likely to be sustained through this period and beyond.	Trend in installed capacity of grid-connected solar rooftop power plants (up to 500 KW)	NA	Sustained growth through 2022
Outcome sustained over time-sustainable development	Long-term	NA	Outside the assessment period (2017-2030)	NA	NA	NA
	Medium-term	2	Employment generation is likely to be sustained with increase in solar rooftop projects.	Trend in employment generation in solar sector	NA	Sustained growth expected from 2022-2030
	Short-term	3	Employment generation is highly likely to be sustained over the	Trend in employment generation in solar sector	NA	Sustained growth through 2022

			short-term with increase in solar rooftop projects.			

8.2 Aggregate results

To arrive at a more general conclusion of the transformational potential of a policy or action, it is necessary to aggregate the results from the in-depth assessment conducted in the previous steps. It is a *key recommendation* to aggregate the results for all characteristics and barriers to the process and outcome level. To do so, users should use Table 8.4, Table 8.5 and Table 8.6, and Figure 8.2.

Aggregating to the category level

Assessment at the category level of processes and outcomes (i.e., technology, agents, incentives, norms, scale of outcome, outcome sustained over time) is based on the assessment of individual characteristics (from Table 8.4 and Table 8.5). When assessing the potential impact of a policy or action at the category level, it is important to assess the degree to which categories of transformational processes and outcomes are important to achieving the vision for transformational change in the particular context. For example, *technology* may be more important in the pre-development phase when a lack of available solar PV hardware is preventing a shift to modern lighting in remote areas. On the other hand, a focus on *norms* may be more critical in a context where the solar PV technology is available but vested interests promote coal-based electricity for lighting.

As shown in Table 8.6, users should use the scale presented in Table 8.3 to score each process and outcome category based on the previous assessment of individual characteristics. Users should consult experts and stakeholders to qualitatively assess each category and assign a score, which is informed by the scores for individual characteristics in Table 8.4 and Table 8.5. Users can adjust the relative importance of each process category by using percentages, as shown in Table 8.6. The relative importance of each category is expressed as a share of the 100%. The relative importance of all four process categories should add up to 100%. Table 8.6 and Table 8.7 provide a template for describing the results.

Table 8.4: Template for describing results of the ex-ante analysis at process category level – solar PV policy example

Category	Score	Rationale for scoring	Relative importance of category including rationale
Technology	3	The policy or action will positively influence the penetration of solar in the country. Since the technology is known, adoption and scale up are important to focus on over the assessment period.	30% The country is still in the pre-development phase, which emphasises the importance of introducing solar PV technology.
Agents	2	Overall the policy is likely to engage entrepreneurs in bringing transformation.	30% Entrepreneurs and coalitions who can introduce and lead technology penetration is equally important to technology change.
Incentives	2	The policy is likely to fully utilize financial incentives and institutions and regulations;	30%

		however it is not likely to utilize disincentives to discourage the use of fossil fuels.	In a developing country context the role of financial incentives and institutional capacity at all levels is crucial to support technology and agents of change.
Norms	1	The policy is less likely to bring significant shifts in this category.	10% Demonstrating the benefits of solar PV technology is more important than changing norms in society at this early stage of transition.

Table 8.5: Template for describing results of the ex-ante analysis at outcome category level – solar PV policy example

Category	Score	Rationale for scoring
Scale of outcome-GHGs	3	The policy is expected to result in GHG and sustainable development impacts that relative to the starting situation represent large impacts at national and subnational levels.
Scale of outcome – sustainable development	2	Net positive large increase in jobs is highly likely though some regions in the country are expected to experience below average employment generation.
Outcome sustained over time – GHGs	3	Based on the policy's expected impact on adoption and scale up, it is highly likely that the policy or action will lead to sustained reductions in emissions through penetration of solar in the country.
Outcome sustainable over time – sustainable development	2	It is likely that over time all regions will experience sustained growth in employment in the solar sector.

Aggregating to the impact level – processes and outcomes

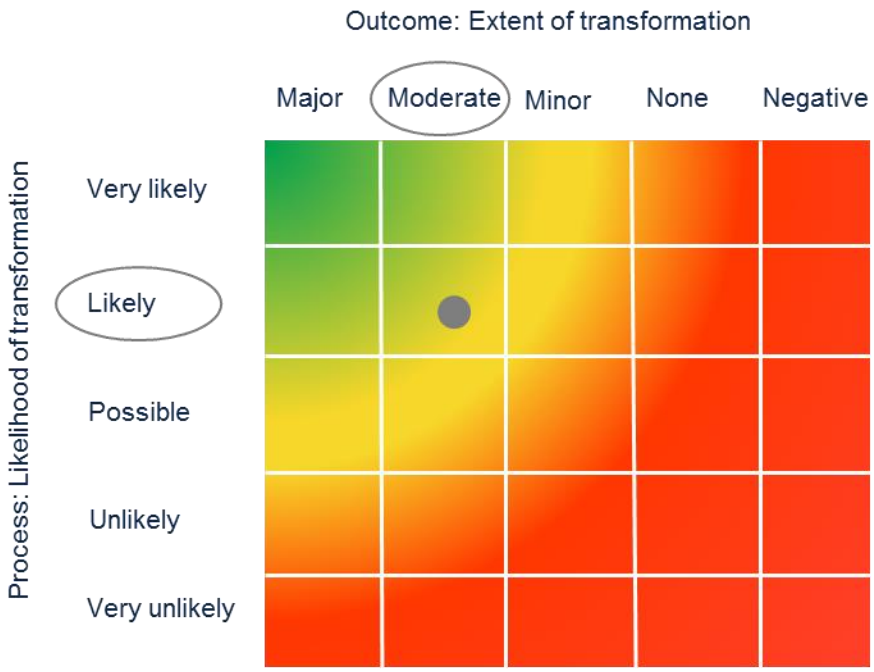
Next, users should arrive at an overall assessment at the impact level, informed by the assessment of processes and outcomes at the category level (as described in Table 8.4 and Table 8.5). Users apply the scale provided in Table 8.6 to qualitatively score the extent of transformation expected from the policy or action at both the outcome and the process level.

Table 8.6: Scale for scoring process and outcome

Outcome - extent of transformation	Process – likelihood of transformational outcome
Major	Very likely
Moderate	Likely
Minor	Possible
None	Unlikely
Negative	Very unlikely

The final result indicates the extent of transformation expected by the policy or action and how likely it is that this expected transformation can be realized given the way the intervention is designed. Figure 8.2 illustrates the matrix of possible qualitative scores for process and outcome impacts and includes the final result for the hypothetical solar PV policy example. When the final result for the policy or action falls in the green area, it indicates that the policy or action is expected to be transformational. When it is situated in the red area, the policy cannot be considered transformational. The colour gradient of the matrix reflects the qualitative nature of the analysis and the high uncertainty associated with the assessment.

Figure 8.2: Transformational impact matrix – illustrating the solar PV policy example



The final result for the hypothetical solar PV policy (illustrated in Figure 8.2) concludes that the extent of transformation expected by the policy is *moderate* and the outcome is *likely* to be sustained over time. This overall impact is achieved through technological change, engaging agents of change and using incentives and regulations, whereas there is scope to strengthen the impact through greater emphasis on norms and behaviour. It suggests that the policy design is on track and with greater attention to some of the process characteristics related to norms and behaviour, it may be possible to further expand, deepen and sustain transformational change. Box 8.1 provides a case study example of how ex-ante transformational impact assessment results are presented and illustrated in the case of the Tonga Energy Efficiency Master Plan.

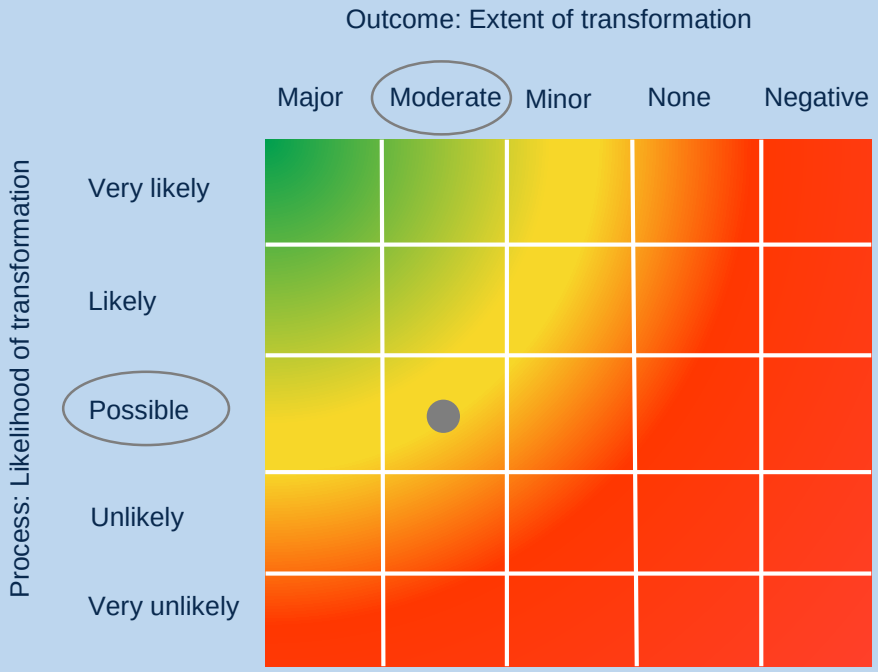
Box 8.1: Tonga Energy Efficiency Master Plan case study example

At the request of the Government of Tonga, the Climate Technology Centre and Network (CTCN) has worked closely with the Tongan Energy Department in 2018 to develop a Tonga Energy Efficiency Master Plan (TEEMP) for adjustment and adoption by the relevant Tongan entities. The TEEMP encompasses electricity use and ground transportation and complements the approach of the 2009 Tonga Energy Road Map 2010–2020 (TERM). The TERM focuses on reducing Tonga's fossil fuel dependence through increased energy efficiency and improved supply chains to mitigate the price

volatility of imported products as well as reduce greenhouse gas (GHG) emissions and improve national energy security.

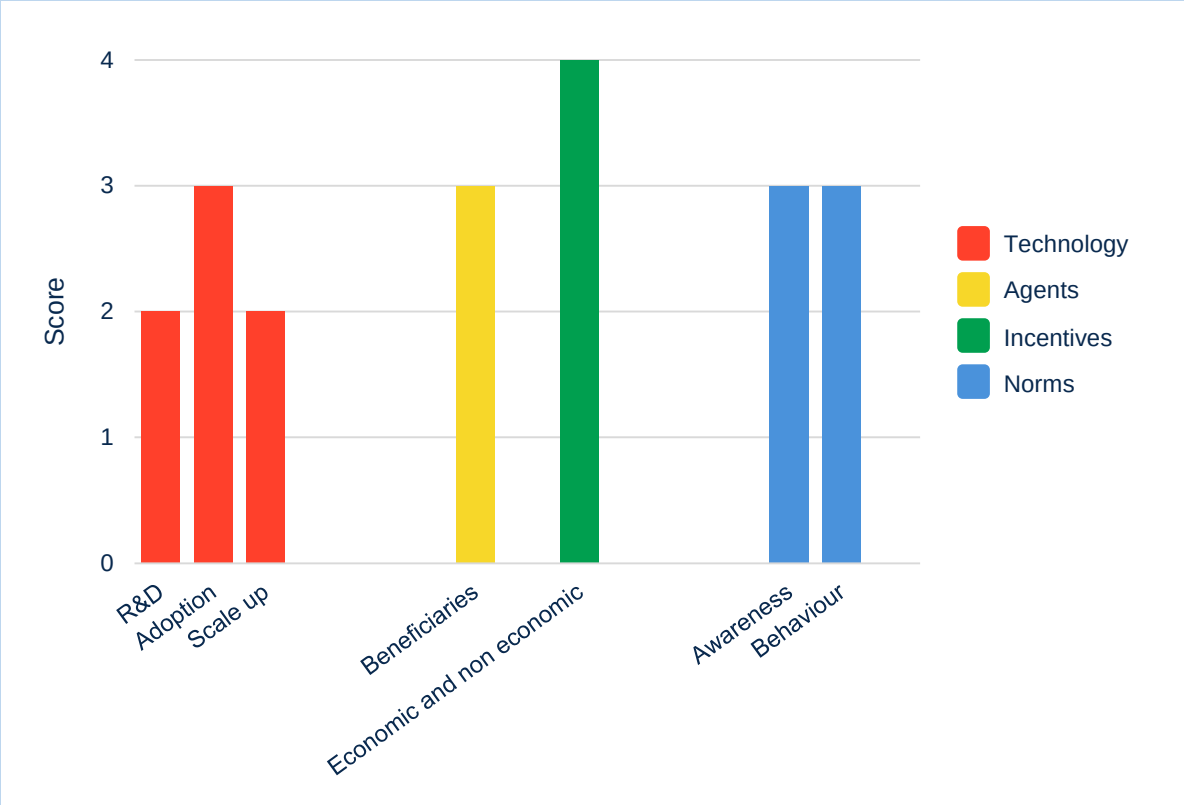
The CTCN has applied the Initiative for Climate Action Transparency (ICAT) Transformational Change Methodology on the technical assistance in Tonga as a pilot in order to provide further clarity on the transformational impacts of its operations, as requested in the Technology Framework of the Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC). The assessment was performed ex-ante during January to April 2019.

The assessment concludes that the extent of transformation expected to be achieved by the TEEMP is *moderate* and the outcome is *possibly* sustained over time as shown below.

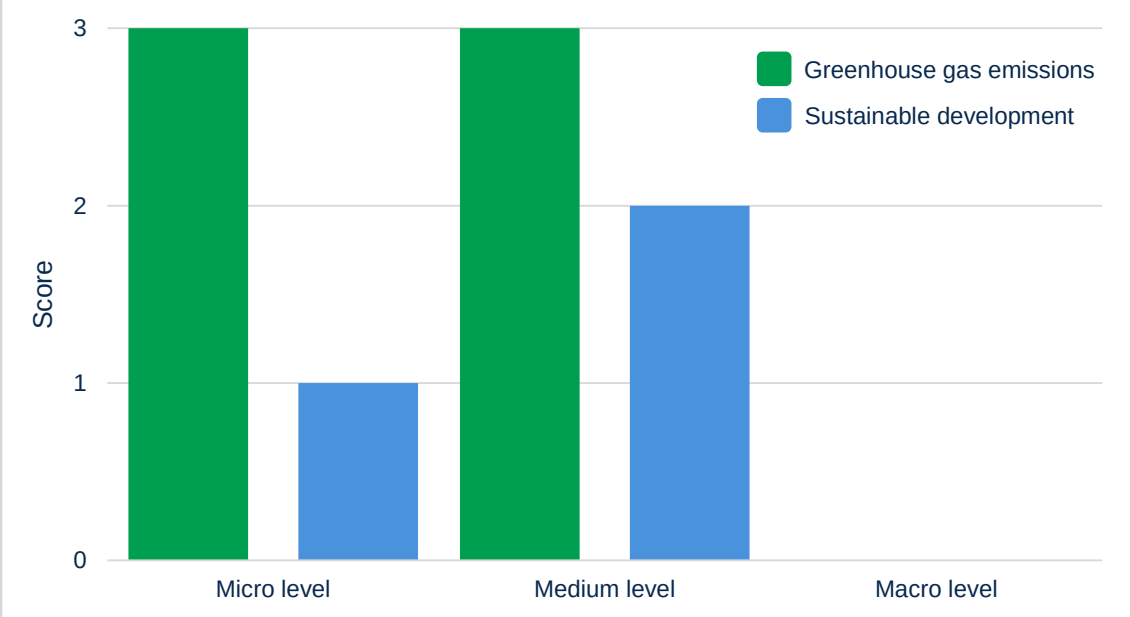


The basis for this conclusion on the expected transformational impact of a policy or action is the aggregation of results in the previous steps. Assessment at the category level of processes and outcomes (i.e., technology, incentives, norms, scale of outcome, outcome sustained over time) is based on the assessment of individual characteristics. The figures below illustrate a break-down of the overall assessment result to the level of disaggregated process and outcome characteristics.

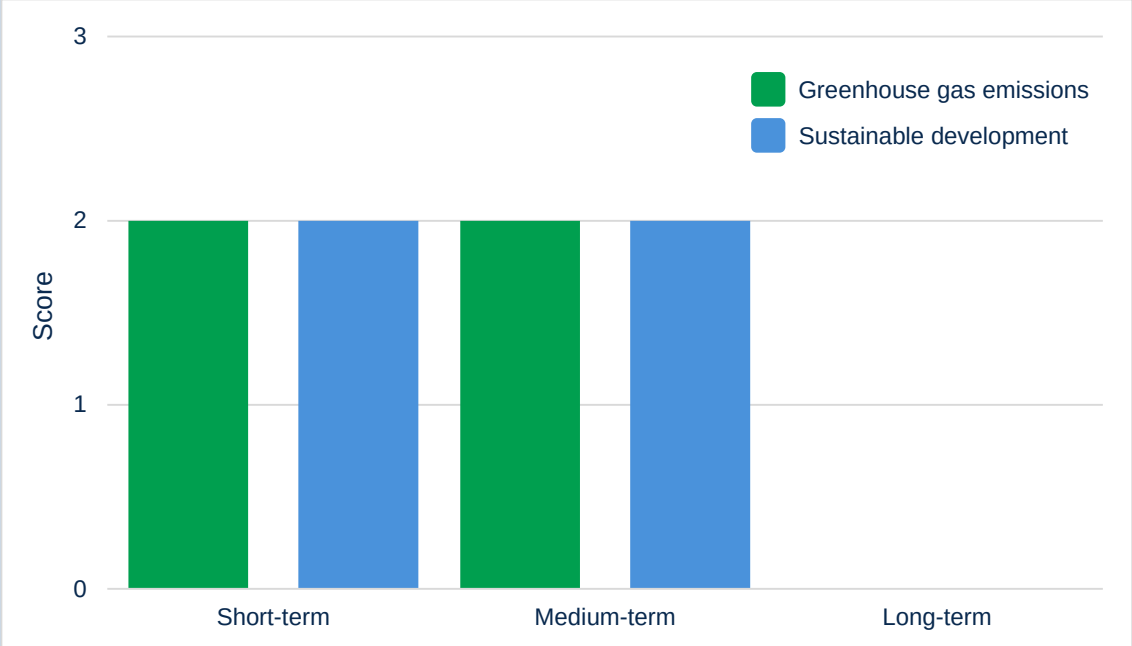
The figure below illustrates the scoring and likelihood that the assessed Tonga Energy Efficiency Masterplan policies and actions may impact the transformational change characteristics over the assessment period.



The next figure illustrates to what extent said policies or actions may result in GHG impacts that relative to the starting situation represent large emission reductions at the levels of assessment targeted.



The last figure illustrates to what extent the policies and actions may result in GHG or sustainable development impacts that are likely to be sustained over the assessment period.



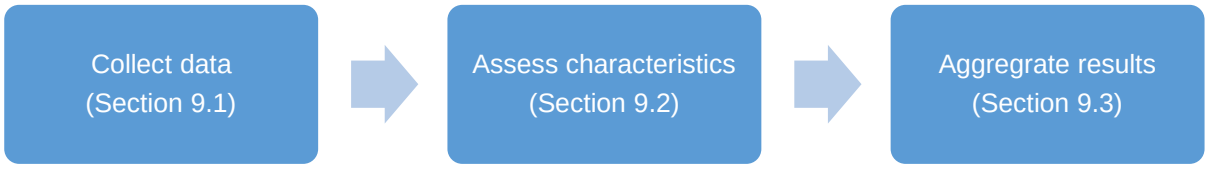
The overall and disaggregated assessment results indicate that the TEEMP, if implemented, is expected to result in GHG emission reduction and moderate sustainable development impacts such as job creation, energy security and reduced energy intensity at multi-scale levels.

The expected transformational impact may be achieved through scale-up of national capacity and access to energy efficiency technologies (EE) and conservation measures, engaging agents of change such as consumers and beneficiaries, using financial and other incentives and regulations for behavioral change, and strengthening national institutions to implement the proposed policies and actions in the TEEMP. The results suggest that the TEEMP is potentially transformational if some critical local conditions are met: TEEMP is adopted, adjusted and implemented by the relevant Tongan entities; further attention is given to some of the process and outcome characteristics to ensure sustained technical capacity building; and a more comprehensive focus on adoption and scale-up of proposed EE technologies and conservation measures is put in place, to avoid a relapse to a high-carbon pathway.

9. ESTIMATING TRANSFORMATIONAL IMPACTS EX-POST

This chapter explains the steps for conducting an ex-post assessment of a policy or action to understand the extent of transformation achieved. The steps are almost the same for ex-ante and ex-post assessments. The ex-post assessment excludes the assessment of barriers (most relevant to understanding expected future impacts) and includes collecting data for indicators (most relevant to assessment of impacts achieved).

Figure 9.1: Overview of steps in Chapter 9



Checklist of key recommendations

- Collect data for selected indicators
- Assess characteristics using indicators to assess the extent of transformation achieved by the policy or action
- Aggregate the results for all characteristics to the process and outcome level and describe the overall assessment

9.1 Collect data for ex-post assessment

Ex-post assessment is a backward looking qualitative and/or quantitative assessment of indicators. This is important to measure the extent of transformation achieved by a policy or action – including unintentional changes[11] - towards contributing to a vision for transformational change to low carbon and sustainable development. It provides users with observed information about the implementation process to understand whether and how policies and actions have been transformational relative to the starting situation as described in Chapter 7.

The transformation achieved is the change between the current situation and the starting situation (described in Chapter 7). Selected indicators are used to assess specific changes in characteristics impacted by the policy or action. It is a *key recommendation* to collect data for selected indicators. Table 9.2 and Table 9.3 provide templates for collecting data. Refer to Section 7.1 for information on selection of indicators and to Appendix A for examples of indicators.

The nature of an indicator determines the method of assessment and whether its value is better assessed quantitatively or qualitatively. Qualitative indicators enable descriptive and narrative data for characteristics, whereas quantitative indicators are estimated or measured to demonstrate the transformational extent of a policy or action on the characteristics.

[11] Transformational change is highly uncertain and may not unfold as planned, though managed transition is the focus of this assessment. To include unintentional changes in the assessment a broad approach is taken to monitor all characteristics of a system possibly relevant to the policy or action (see Chapter 7). Users can choose to monitor indicators for not relevant characteristics to take a comprehensive approach.

The appropriate method of assessment is determined specific to each indicator. Methods of assessment can be classified into bottom-up methods and top-down methods. Often top-down methods are appropriate for a large number of affected actors, whereas bottom-up methods are more appropriate for a smaller number of affected actors or entities, where data is available and feasible to collect.

Examples of bottom-up methods are direct data collection from affected stakeholders, facilities or entities through monitoring of indicators (such as energy consumption and costs per KWh), sampling methods or use of default values from similar policies and actions to estimate effects (such as the average reduction in grid-connected electricity use per building that installs solar PV). Examples of top-down methods are use of existing data at sector or subsector level and energy or transport modelling relying on statistically collected data to assess changes in indicator values.

For further guidance on data collection methods and monitoring of performance over time based on indicators, refer to Chapter 10 and to Appendix A, where examples of indicators of transformational change characteristics are provided.

9.2 Assess characteristics for ex-post assessment

The next step is to assess the policy or action's impact on process and outcome characteristics based on a comparison of indicator values for the starting situation and ex-post situation.

It is a *key recommendation* to assess characteristics using indicators to assess the extent of transformation achieved by the policy or action (using the scale in Table 9.1 and templates in Table 9.2 and Table 9.3). The ex-post indicator value is based on observed data and shows the extent to which the policy or action has influenced the characteristic relative to the starting situation. Users are encouraged to identify multiple indicators for each characteristic in their assessments. Only one indicator per characteristic has been chosen here for illustration purposes.

A qualitative scale is used for scoring the transformational characteristics based on the indicator values. Table 9.1 provides scales for scoring process and outcome characteristics. Assessing outcome characteristics helps to understand the degree of transformational change achieved. Ex-post assessment of process characteristics gives insights into the drivers that helped achieve the outcome and can be used to improve policy design or inform new policies. It shows whether barriers were overcome, to what extent and how, which can also help in future policy making.

Engaging stakeholders in scoring characteristics and determining relative importance can bring new insights and lend credibility to the process. Refer to the ICAT *Stakeholder Participation Guide* (Chapter 8) for information on designing and conducting consultations.

Table 9.1: Scale for scoring characteristics

Scale[12]	Description of scale
Process characteristics	
4	It is very likely that the policy or action had a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 90-100%)
3	It is likely that the policy of action had a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 66-90%)
2	It is possible that the policy or action had a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 33-66%). Instances where the likelihood is unknown or cannot be determined should be considered possible.
1	It is unlikely that the policy or action had a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 10-33%)
0	It is very unlikely that the policy or action had a significant positive impact on this characteristic over the assessment period (for example, a probability in the range of 0-10%)
Outcome characteristics – scale (GHG and sustainable development impacts)	
3	The policy or action resulted in GHG impacts that relative to the starting situation represent large emission reductions at the level of assessment targeted The policy or action resulted in sustainable development impacts that relative to the starting situation represent significant, positive sustainable development impacts at the level of assessment targeted
2	The policy or action resulted in GHG impacts that relative to the starting situation represent moderate emissions reductions at the level of assessment targeted The policy or action resulted in sustainable development impacts that relative to the starting situation represent moderate, positive sustainable development impacts at the level of assessment targeted
1	The policy or action resulted in GHG impacts that relative to the starting situation represent minor emission reductions at the level of assessment targeted The policy or action resulted in sustainable development impacts that relative to the starting situation represent minor, positive sustainable development impacts at the level of assessment targeted
0	The policy or action did not result in GHG impacts relative to the starting situation at the level of assessment targeted The policy or action did not result in sustainable development impacts relative to the starting situation at the level of assessment targeted
-1	The policy or action resulted in GHG impacts that relative to the starting situation represent a net increase in emissions at the level of assessment targeted

[12] The scale uses numbers as a simple reference to qualitative scores explained in this table. When aggregating across characteristics, the number scores should not be used in a numerical way, for example, they should not be averaged to obtain category-level scores.

	The policy or action resulted in GHG that relative to the starting situation represent negative sustainable development impacts at the level of assessment targeted
Outcome characteristics – sustained over time (GHG and sustainable development impacts)	
4	The policy or action resulted in GHG impacts that are very likely to be sustained over the assessment period (for example, a probability in the range of 90-100%) The policy or action resulted in sustainable development impacts that are very likely to be sustained over the assessment period (for example, a probability in the range of 90-100%)
3	The policy or action resulted in GHG impacts that are likely to be sustained within the assessment period (for example, a probability in the range of 66-90%) The policy or action resulted in sustainable development impacts that are likely to be sustained within the assessment period (for example, a probability in the range of 66-90%)
2	The policy or action resulted in GHG impacts that are possibly sustained within the assessment period (for example, a probability in the range of 33-66%). Instances where the likelihood is unknown or cannot be determined should be considered possible. The policy or action resulted in sustainable development impacts that are possibly sustained within the assessment period (for example, a probability in the range of 33-66%). Instances where the likelihood is unknown or cannot be determined should be considered possible.
1	The policy or action resulted in GHG impacts that are less likely to be sustained over the assessment period (for example, a probability in the range of 10-33%) The policy or action resulted in sustainable development impacts that are less likely to be sustained over the assessment period (for example, a probability in the range of 10-33%)
0	The policy or action resulted in GHG impacts that are unlikely to be sustained over the assessment period and risk being reversed to negative impacts (for example, a probability in the range of 0-10%) The policy or action resulted in sustainable development impacts that are unlikely to be sustained over the assessment period and risk being reversed to negative impacts (for example, a probability in the range of 0-10%)

Table 9.2: Template for ex-post assessment of process characteristics based on indicators[13]

Category	Characteristic	Score	Rationale justifying the score	Indicators	Indicator value at starting situation (2016)	Indicator value observed (2030)
Technology	Research and development	NA	Not relevant	NA	NA	NA
	Adoption	2	The financial subsidy and feed-in tariff have helped increase the adoption of clean technology and kick started the local industry.	Number of demonstration projects for solar rooftop PV initiated (annual)	0	7

[13] The table builds on the information generated in the earlier step which is represented in grey columns.

	Scale up	2	Financial subsidy and feed-in tariff have led to a significant uptake of solar in the country over the assessment period while enhancing the availability of both technology and skilled workforce for installation and maintenance. It has kick-started the local manufacturing and service industry.	Share of installed PV rooftop in the solar sector (nationwide or statewide	5%	20%
Agents	Entrepreneurs	2	The policy has triggered investments and entrepreneurship in solar-related businesses compared to the starting situation when high upfront financial investment was a significant barrier.	Volume of venture capital investments	USD 100 million	USD 500 million
	Coalition of advocates	2	Solar PV policy has indirectly supported the creation of coalitions and networks.	Number of projects/research centers involving university-industry collaboration	1	6
	Beneficiaries	NA	Not relevant	NA	NA	NA
Incentives	Economic and non-economic incentives	3	Solar PV policy utilized subsidies and preferential tariff as means to increase technology penetration. These incentives have promoted consumer demand, which in turn has promoted the local service industry.	Number of new economic incentives in place for solar	1	4
	Disincentives	0	Solar PV policy did not use disincentives to achieve its goals. There is a growing recognition of a need for a comprehensive strategy but no steps have been taken in this direction yet.	Number of new disincentives to discourage fossil fuels to generate electricity	1	1
	Institutions and regulations	2	Solar PV policy has led to the development of new agencies and regulations to promote solar in a few front runner states.	Number of new regulations and institutions set up to promote solar	3	6
Norms	Awareness	NA	Not relevant	NA	NA	NA
	Behaviour	2	Solar PV policy has somewhat influenced consumer behaviour and shifted their preferences away from carbon intensive	Number of new measures to influence consumer behaviour in favor of	None	1

			electricity as a result of targeted financial incentives. However, in the absence of a strategy to discourage fossil fuels, a widespread change in behaviour has not happened.	solar/ renewable energy		
	Social norms	0	While 1-2 states have emerged as leaders in the solar industry, a sustained change in societal norms favoring solar or renewable in general has not been observed yet.	Number of emerging leaders/role models (e.g., states leading the transition to renewable energy) favoring renewables	0	1-2

Table 9.3: Template for ex-post assessment of outcome characteristics based on indicators[14]

Category	Characteristic	Score	Rationale justifying the score	Indicators	Indicator value at starting situation	Indicator value observed
Scale of outcome - GHGs	Macro level	NA	Outside the assessment boundary	NA	NA	NA
	Medium level	2	The policy almost achieved its ambitious 2022 solar rooftop target but in 2030. The emissions reduction impacts are significant but fell short of the vision.	Installed capacity of grid-connected solar rooftop power plants (up to 500 KW) at a national level	1 GW	36 GW
	Micro level	2	The policy achieved its national level targets through developing solar power in states and cities. While 1 state led in solar rooftop scale up achieving high levels of penetration, but others showed moderate growth over the assessment period.	Installed capacity of grid-connected solar rooftop power plants (up to 500 KW) at a subnational level (state level average capacity)	100 MW	800 MW
Scale of outcome – sustainable development	Macro level	NA	Outside the assessment boundary	NA	NA	NA
	Medium level	1	Growth is solar was accompanied by a large boost to employment in this sector but it was much smaller than anticipated.	Employment generation in solar sector at a national level	10,000	190,000
	Micro level	1	A large part of the employment growth was concentrated in two states with other regions not	Employment generation in solar sector at a subnational level	600	30,000

[14] The table builds on the information generated in the earlier step which is represented in grey columns.

			being able to reap the benefits as much			
Outcome sustained over time - GHGs	Long-term	NA	Outside the assessment period	NA	NA	NA
	Medium term	2	The policy made sustained gains over the assessment period and no reversal of impacts is expected at the time of assessment. Financial incentives and feed-in tariff are expected to be phased out but the penetration achieved is expected to continue.	Trend in installed capacity of grid-connected solar rooftop power plants (up to 500 KW)	NA	Sustained growth during the assessment period
	Short-term	2	In the short-term, the policy did not result in sustained gains. And, there was a significant risk of policy reversal due to political changes in the first 5 years of the policy implementation.	Trend in installed capacity of grid-connected solar rooftop power plants (up to 500 KW)	NA	Uneven growth through 2022
Outcome sustained over time – sustainable development	Long-term	NA	Outside the assessment period	NA	NA	NA
	Medium term	2	Employment generation was sustained and showed an increasing trend through the assessment period with steady increase in solar rooftop projects.	Trend in employment generation in solar sector	NA	Sustained growth during the assessment period
	Short-term	1	Employment generation in the beginning was not steady as the risk of policy reversals affected investor confidence and held back the growth in solar rooftop projects and consequently jobs.	Trend in employment generation in solar sector	NA	Flat trend through 2022

9.3 Aggregate results

Once the characteristics have been assessed, the next step is to aggregate the analysis to understand the impact of the policy or action at the category level, then the process and outcome level, and finally use it to understand the extent of transformation achieved by the policy or action.

It is a *key recommendation* to aggregate the results for all characteristics to the process and outcome level and describe the overall assessment.

Aggregate to the category level

The assessment of process and outcome categories is based on the assessment of individual characteristics, which, in turn, is based on indicators (as described in Section 9.2). Process and outcome categories are scored taking into consideration the policy's impact on characteristics within each

category, and using the same scale as in Table 9.1. When assigning a score to each category, it is important to consider the relative importance of categories of characteristics. Table 9.4 and Table 9.5 provide templates to describe category-level qualitative scores. Table 9.4 asks users to also note the relative importance of each process category expressed as a percentage, with the sum of all process categories adding to 100%. For instance, the technology (30%), agents (30%) and incentives (30%) categories are relatively more important than the norms category (10%) in the given example (in Table 9.4 and Table 9.5). For outcomes, each category—scale of outcome and outcome sustained over time—is considered equally important for transformational change.

Ex-post assessment focuses on observed indicator values. Barriers are inherent in these values, as they would have affected the performance of the policy or action, which is captured by the indicator in the assessment. Therefore, barriers are not assessed separately in ex-post assessment. Users can nevertheless choose to do barrier analysis following the methodology given in Section 8.2, for example, to understand the underlying reasons for the policy's lack of significant impact on a characteristic or category. Users can also consult Chapter 12, which discusses how to use the assessment results for learning and policy improvement.

Table 9.4: Template for describing results of the ex-post analysis at process category level

Category	Score	Rationale for scoring	Relative importance of category including rationale
Technology	2	Based on the policy's impact on adoption and scale up, it can be said that the policy or action positively influenced the penetration of solar in the country. Since the technology itself is known, adoption and scale up were relatively more important to focus on over the assessment period.	30% Given the starting situation, technology, incentives and agents are considered equally important to achieve transformational change in the solar sector.
Agents	1	While the policy had a positive impact on businesses and influencing entrepreneurs, investors, and other coalitions and networks, it did not support the development of a strong constituency at a grassroots level.	30% Given the starting situation, technology, incentives and agents are considered equally important to achieve transformational change in the solar sector.
Incentives	2	The policy utilized financial incentives which were at its core and led to the development of enabling institutions and regulations in a few front runner states. However, it failed in spurring new actions involving disincentives to discourage the use of fossil fuels, thus limiting its ability to cause transformational change through these instruments.	30% Given the starting situation, technology, incentives and agents are considered equally important to achieve transformational change in the solar sector.
Norms	0	The policy did not bring significant shifts in this category and the societal norms and	10%

		behaviour continue to favour carbon intensive forms of energy.	Changing norms in society is considered less important in the context of the pre-development phase, until the technology has proved its benefits given the costs, and is ready for take-off.

Table 9.5: Template for describing results of the ex-post analysis at outcome category level

Category	Score	Rationale for scoring
Scale of outcome - GHGs	2	The policy achieved a moderate change in GHG emissions reductions and sustainable development impacts, relative to starting situation.
Scale of outcome - Sustainable development	1	Net positive large increase in jobs were seen in some regions but these were not distributed evenly across the country.
Outcome sustained over time – GHGs	2	The policy's GHG impacts were sustained over the assessment period and there is only a small risk that the gains made may be reversed with feed-in tariff and subsidy no longer in place.
Outcome sustained over time – sustainable development	1	Sustained growth in employment was not seen across the country and was limited to a few pockets.

Aggregating to the impact level – processes and outcomes

The final ex-post assessment result is arrived at by aggregating the qualitative scores for process and outcome categories, while considering the relative importance of each category. The overall assessment indicates how high is the extent of transformation achieved (outcome) by the policy or action and how likely it is that this transformational is sustained over time (process). Table 9.6 provides the scale for scoring outcome and process impacts.

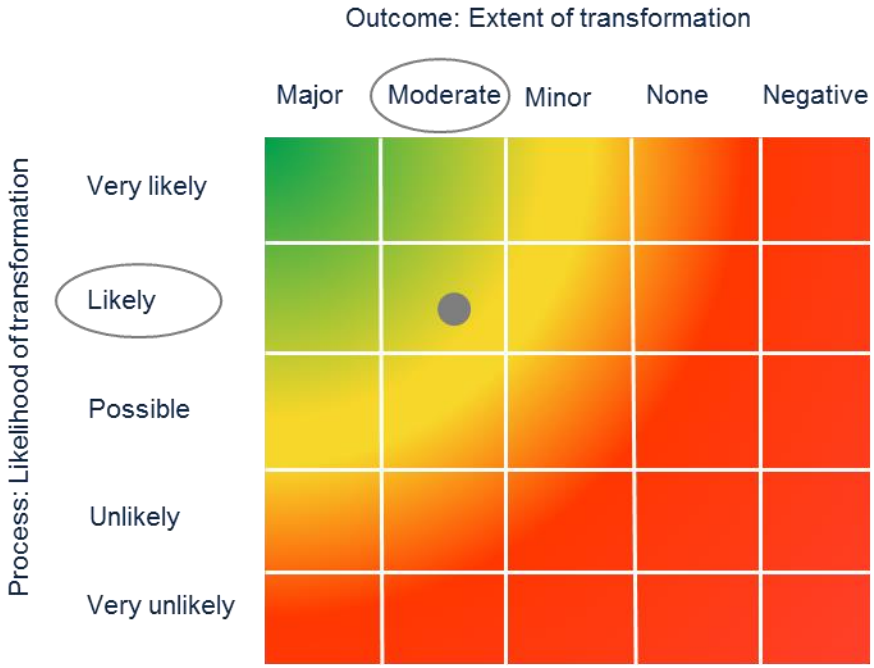
Table 9.6: Scale for scoring outcome and process categories

Outcome - extent of transformation achieved is	Process - transformational outcome is
Major	Very likely
Moderate	Likely
Minor	Possible
None	Unlikely
Negative	Very unlikely

Figure 9.2 illustrates the matrix of possible qualitative scores for process and outcome impacts. When the final result for the policy falls in the green area, it indicates that a policy or action is transformational. When it is situated in the red area, the policy is not (yet) transformational. The colour gradient of the matrix reflects the qualitative nature of the analysis and the high uncertainty associated with the assessment.

Figure 9.2 illustrates the final result for the hypothetical solar PV policy. Based on Table 9.4 and Table 9.5 and the scale for scoring in Table 9.6, the ex-post assessment for this hypothetical policy concludes that the extent of transformation achieved by the policy is *minor* and the outcome is *possibly* sustained over time. This overall impact is achieved through technological change, engaging agents of change and using incentives and regulations, even as there is ample scope to strengthen the impact through greater emphasis on norms and behaviour. It suggests that the policy is potentially on the right course and with greater attention on some of the process characteristics related to norms and behaviour, it may be possible to further expand, deepen and sustain transformational change.

Figure 9.2: Transformational impact matrix – illustrating the solar PV policy example

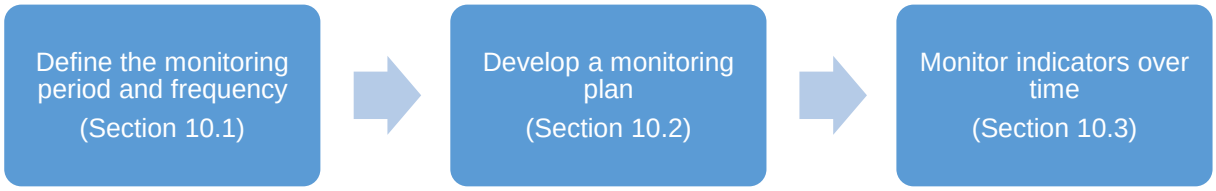


PART IV: MONITORING AND REPORTING

10. MONITORING PERFORMANCE OVER TIME

Monitoring performance of key indicators over time helps to assess progress and understand whether a policy or action is on track to achieve the desired transformational impacts. This chapter provides information on developing a monitoring plan and regularly following the performance of a policy or action. Users conducting ex-ante assessment can choose to skip this chapter.

Figure 10.1: Overview of steps in Chapter 10



Checklist of key recommendations

- Define a monitoring period that is long enough to capture the full range of transformational change impacts
- Develop a plan for monitoring key performance indicators
- Identify the key performance indicators that is used to track performance of the policy or action over time
- Monitor each key performance indicator over time in line with the monitoring plan

10.1 Define the monitoring period and frequency

Monitoring over time creates a time series of data useful for assessing trends. It also provides an opportunity for modifications of policies and actions during the implementation period if progress is not as planned. The first step is to define the monitoring period and monitoring frequency.

Monitoring period

The monitoring period is the time period over which the policy or action is monitored. However, it is worth noting that monitoring in advance of the implementation period, that is, before the implementation of the policy or action, can help define the starting situation. It is a *key recommendation* to define a monitoring period that is long enough to capture the full range of transformational impacts.

The monitoring period also includes the assessment period, the latter being the time period over which GHG impacts resulting from the policy are assessed. There may be a number of assessments (and therefore assessment periods) during the monitoring period.

For ex-post assessments, users can choose to continue monitoring beyond the implementation period to track effects. For example, a policy with an implementation period of 2015-2030 should have at least the same monitoring period or longer (such as 2013-2032). Data collection can hence begin before implementation starts, and continue throughout the implementation period and beyond. Starting data

collection at an early stage (even before policy implementation starts) improves the ability to monitor and evaluate at later stages. In general, the longer the monitoring period is, the more robust the impact assessment is.

Monitoring frequency

The monitoring frequency is generally decided at the beginning of the monitoring period. Users can monitor indicators at various frequencies, such as monthly, quarterly, or annually, depending on the objectives. The appropriate frequency of monitoring should be based on the needs of decision makers and stakeholders. Refer to ICAT *Stakeholder Participation Guide* for engaging stakeholders in this regard (Chapter 5).

Deciding on the monitoring frequency entails trade-offs between the type of impacts and indicators being monitored, cost, and data availability. Clarity on the purpose of each indicator, as well as an understanding of existing data collection practices is helpful to determine frequency. For example, if a policy goal is to create green jobs over 20 years, the indicator related to job creation can be monitored annually through an existing employment report regularly published by another agency. On the other hand, if the purpose is to measure the success of a six-month awareness-raising campaign by an agency, the indicator related to number of agency website visits or media articles can be monitored daily or weekly for the initial 1-2 months, and then monthly for the remainder of the campaign.

When a policy or action includes short-term, medium-term and long-term targets, monitoring should take place at a minimum at the critical milestones (e.g., for a solar PV policy that intends to achieve 60% PV in the electricity mix by 2050, with interim targets of 20% by 2020, 30% by 2030 and 50% by 2040, monitoring of PV share in electricity mix should occur every 10 years or more frequently). In the pre-development or take-off phase of transformational change (Chapter 7), users can decide to monitor indicators more frequently to confirm progress is on track. For example, awareness raising, capacity building, and high-level advocacy can be important for encouraging diffusion and scale-up of solar PV technologies when first introduced to a market. Therefore, indicators related to these efforts along with solar PV sales can be monitored more frequently initially in such a market.

Users may wish to align the monitoring frequency with the five-year reporting cycles of Nationally Determined Contributions and/or national climate or development reporting cycles to embed monitoring within existing processes.

10.2 Develop a monitoring plan

A monitoring plan is important to consistently track progress of indicators over time in relation to goals and to encourage documenting of assumptions and decisions for transparency. It is a *key recommendation* to develop a plan for monitoring key performance indicators

To ensure that the monitoring plan is robust, consider including the following elements in the plan:

- **Roles and responsibilities**: Identify the entity or person responsible for monitoring key performance indicators and clarify the roles and responsibilities of the personnel conducting the monitoring. See “Institutional arrangements for coordinated monitoring” in Section 10.3.
- **Competencies**: Include information about any required competencies and any training needed to ensure that personnel have necessary skills.

- **Methods**: Explain the methods for generating, storing, collating and reporting data on monitored indicators. Include a brief description and source of data for each indicator.
- **Monitoring period and monitoring frequency**: Define the monitoring period and frequency for the policy or action. Section 10.1 discusses these in detail.
- **Collecting and managing data**: Identify the databases, tools or software systems that are used for collecting and managing data and information. Understand what data exists, in what format, how it is collected, as well as critical data gaps, and utilize this to organize a process to collect information, such as description of the indicator, whether qualitative or quantitative data needed, source of data and any relevant assumptions. Table 10.1 provides a template for data collection for the hypothetical solar PV policy.
- **Quality assurance and quality control (QA/QC)**: Define the methods for QA/QC to ensure the quality of data enhance the confidence of the assessment results. Quality assurance is a planned review process conducted by personnel who are not directly involved in the data collection and processing. Quality control is a procedure or routine set of steps that are performed by the personnel compiling the data to ensure the quality of the data.
- **Record keeping and internal documentation**: Define procedures for clearly documenting the processes and approaches for data collection as well as the data and information collected. This is beneficial for improving the availability of information for subsequent monitoring events, documenting changes over time, and creating a historical record for archiving. Define the length of time that data will be archived.
- **Continual improvement**: Include process for improving the methods for collecting and analyzing data and monitoring impacts
- **Financial resources**: Identify the cost of monitoring and sources of funds

Users should review and update the monitoring plan on a regular basis (e.g., annually or biennially). This becomes particularly important for transformational change because of its long-term nature. Some characteristics may become less significant while others may become more significant during this time. Therefore, the monitoring plan should be revisited as new indicators may need to be monitored while some of the existing ones may no longer be of interest.

Table 10.1: Template for data collection – illustrated for the solar PV policy example

Indicator	Type of data (quantitative/ qualitative)	Monitoring frequency and date of collection	Data source/ collection method	Responsible entity	Observed data (unit)
Number of new solar PV installation businesses	Quantitative	Annual (January 2015)	Business license application	Department of Commerce or Energy	8 businesses /year
Number of trainings on solar PV installation	Quantitative	Monthly	Training workshop reports	Department of Energy	1 training /month
% share of solar PV in electricity mix	Quantitative	Annual (January 2015)	Electricity generation data	Department of Energy	5%

10.3 Monitor indicators over time

Monitoring of indicators helps to track performance of the policy or action over time. It is a *key recommendation* to identify the key performance indicators that is used to track performance of the policy over time.

For each characteristic included in the assessment, users identify indicators to monitor performance of the policy or action over time. Appendix A provides examples of indicators for process and outcome characteristics of transformational change. Section 7.3 also discusses selection of indicators to assess policy or action's impact in relation to the starting situation. When selecting indicators, users should consider the intended objectives of monitoring, the nature of the policy or action, the characteristics being assessed, stakeholder priorities, and feasibility. Feasibility may depend on data availability, resources needed and technical capacity to collect data. If data is not available or it is not cost-effective to collect data for an indicator, users can either consider proxy data or select another indicator where possible. Reasons for selecting indicators and data-related assumptions should be explained and justified.

An inclusive stakeholder consultation process can help ensure the relevance and completeness of selected indicators. The ICAT *Stakeholder Participation Guide* provides further information on designing and conducting consultations (Chapter 8).

It is a *key recommendation* to monitor each indicator over time in line with the monitoring plan. Users take monitoring results into account when estimating transformational impacts ex-post. If monitoring indicates that the estimates underlying the qualitative scores used in the ex-ante assessment are no longer valid, users should document the differences and use the monitoring results to update the ex-ante estimates.

Institutional arrangements for coordinated monitoring

Information on key performance indicators can be dispersed among different institutions. Given the wide variety of data needed for impact assessment and a range of different stakeholders involved, strong institutional arrangements play a central role in coordinating monitoring activities. A technical coordinator, or a coordinating team can be assigned to lead monitoring, data collection and management even as

responsibilities are delegated to different institutions. Users may wish to entrench these roles in institutions responsible for monitoring of long-term strategies or NDCs or national climate or development plans to bring greater efficiency. This also reduces the risk of funding gaps for monitoring over long periods. Further, depending on the data sources identified, it may be worthwhile to pursue formal partnerships or Memorandums of Understanding (MoUs) for longer-term data collection and assess opportunities such as census to gather key data.

It can be useful to embed a collection of key indicators within the data gathering system of a relevant ministry, agency or department, or identify another existing reporting system within which specific key indicators could be housed. Countries may already have monitoring institutions in place as part of their national MRV system. Users can expand the national MRV system to also monitor the impact of the policy.

Where strong institutional arrangements do not yet exist, countries can identify a coordinating body with adequate capacity and authority to be responsible for monitoring. And if necessary, provide a legal mandate to the coordination body to collect and monitor information. Given the longer-term nature of transformational change, a key consideration is to appropriately budget for monitoring and analysis, and secure the necessary financial resources. Institutional mandates strengthen the procedures and the system, and can help ensure funding.

11. REPORTING

Reporting the results, methodology and assumptions used is important to ensure that the impact assessment is transparent and gives decision makers and stakeholders the information they need to properly interpret the results. This chapter presents a list of information that is recommended to be included in an assessment report.

Checklist of key recommendations

- Report information about the assessment process and the transformational impacts resulting from the policy (including information listed in Section 11.1)

11.1 Recommended information to report

It is a *key recommendation* to report information about the assessment process and the transformational impacts resulting from the policy (including the information listed below). A Reporting Template is provided for users on the ICAT website. Where two or more methodology documents are applied to the policy, the general information and policy description only need to be reported once. The list below does not cover all chapters in this document because some chapters provide information not relevant to reporting. Refer to the ICAT *Stakeholder Participation Guide* to learn more about providing information to stakeholders (Chapter 7).

Chapter 2: Objectives

- Describe the objective(s) and intended audience(s) of the assessment

Chapter 4: Key concepts, steps, and assessment principles

- Discuss opportunities for stakeholders to participate in the assessment
- List the principles on which the assessment is based

Chapter 5: Describing the policy or action and the assessment boundary and period

- State whether the assessment applies to an individual policy/action or a package of related policies/ actions, and when a package is assessed, which policies and actions are included in the package
- Provide a description of the policy or action (or package of policies or actions) (including the information in Table 5.1)
- Whether the assessment is ex-ante, ex-post, or a combination of ex-ante and ex-post
- State the assessment boundary in terms of impacts covered, and geographical and sectoral coverage
- State the assessment period

Chapter 6: Choosing which transformational change characteristics to assess

- Describe the phase of transformation to understand the context in which the policy or action is being implemented
- Describe the policy or action's vision for transformational change (including information in Table 6.3)
- Describe identified barriers to transformational change (including information in Table 6.4)
- Describe relevant transformational change characteristics of the policy or action (including information in Table 6.6 and Table 6.7)

Chapter 7: Assessment of the starting situation

- Describe the starting situation for characteristics impacted by the policy or action (including information in Table 7.1 and Table 7.2)

Chapter 8: Estimating impacts ex-ante

- Describe the final ex-ante assessment result expressed in terms of the extent of transformation expected and the likelihood that the expected transformation can be realized over the assessment period, and provide the underlying rationale
- Discuss disaggregated results in terms of the policy or action's expected impact on individual characteristics (including the information in Table 8.2, Table 8.3, Table 8.4 and Table 8.5)

Chapter 9: Estimating impacts ex-post

- Describe the final ex-post assessment result expressed in terms of the extent of transformation achieved and the likelihood that the transformation is sustained over time, including the underlying rationale for the conclusions
- Discuss disaggregated results in terms of the policy or action's impact on individual characteristics using indicators (including the information in Table 9.2, Table 9.3, Table 9.4 and Table 9.5)

Chapter 10: Monitoring performance over time

- State the monitoring period
- Describe the performance of the policy or action over time, as measured by the indicators, and whether the performance of the policy or action is on track relative to expectations
- Discuss whether the assumptions for key indicators within the ex-ante assessment remain valid, if relevant

Chapter 12: Learning, Decision Making and Using Results

- Provide insights gained from the assessment, and how results are used to revise ongoing or future policies and actions

PART V: DECISION MAKING AND USING RESULTS

12. LEARNING, DECISION MAKING AND INTERPRETING RESULTS

Interpreting the assessment results is important for learning and decision making to promote transformational change for climate and sustainable development goals. This chapter provides information on how to understand assessment results and apply insights gained at different stages of planning and implementation in the policy and action cycle.

Checklist of key recommendations

- Describe insights gained from the assessment, and how results are used to revise objectives, design, planning, and implementation of ongoing or future policies and actions.

12.1 Understanding assessment results

Learning from results is an integral part of an assessment exercise. It is important that users understand the benefits as well as the limitations of transformational change assessment to make the best use of the results.

The assessment that has been described here is to a large extent qualitative and based on expert judgment. This is not a shortcoming but a simple reality to be kept in mind. It does mean, however, that the assessment is limited by the extent of human knowledge about complex inter-acting systems and their processes. Users should seek to be realistic about these types of predictions and not be deterred by the fact that the outcome may not be exactly what had been expected. It is better to be approximately right than exactly wrong.

Ex-ante assessment for transformational change, in particular, involves high uncertainty given the unpredictable nature of how complex systems evolve over long-term. Uncertainty increases when the objective is to seek a deviation from established pathways. This rules out the use of established methods of predicting future development based on past experiences of trends and drivers. Ascertaining what triggers this deviation and what magnitude of change can be expected is highly speculative. This is one reason why this methodology focuses on the transparency of reporting of assumptions and choices made.

There is a lot of flexibility provided at each step in applying the assessment framework, as the methodology is applicable for a wide variety of policies and actions. Different choices made during the assessment, however, limit the comparability of results between different assessments.

Despite these limitations, the assessment results can greatly aid in prioritizing policies, modifying existing interventions to enhance their transformational potential, and shortlisting actions for financial support. Depending on the objective of the assessment, users will want to look deeper at different aspects of the results of the assessment described within this methodology. Also, depending on the case, disaggregated and singular results (for example, the assessment of high upfront investment costs as a barrier to achieving impact on the *entrepreneurs* characteristic) can be more helpful than aggregated and numerical results (for example, a numerical score at the category level stating that the expected impact of the policy for technology change is ‘3’).

12.2 How to apply results

As outlined above, the assessment of transformational impact is not an exact science but a learning exercise that can provide valuable insights and support decision making. How to use which type of results from the assessment (e.g., at a more or less aggregate level) depends strongly on two factors:

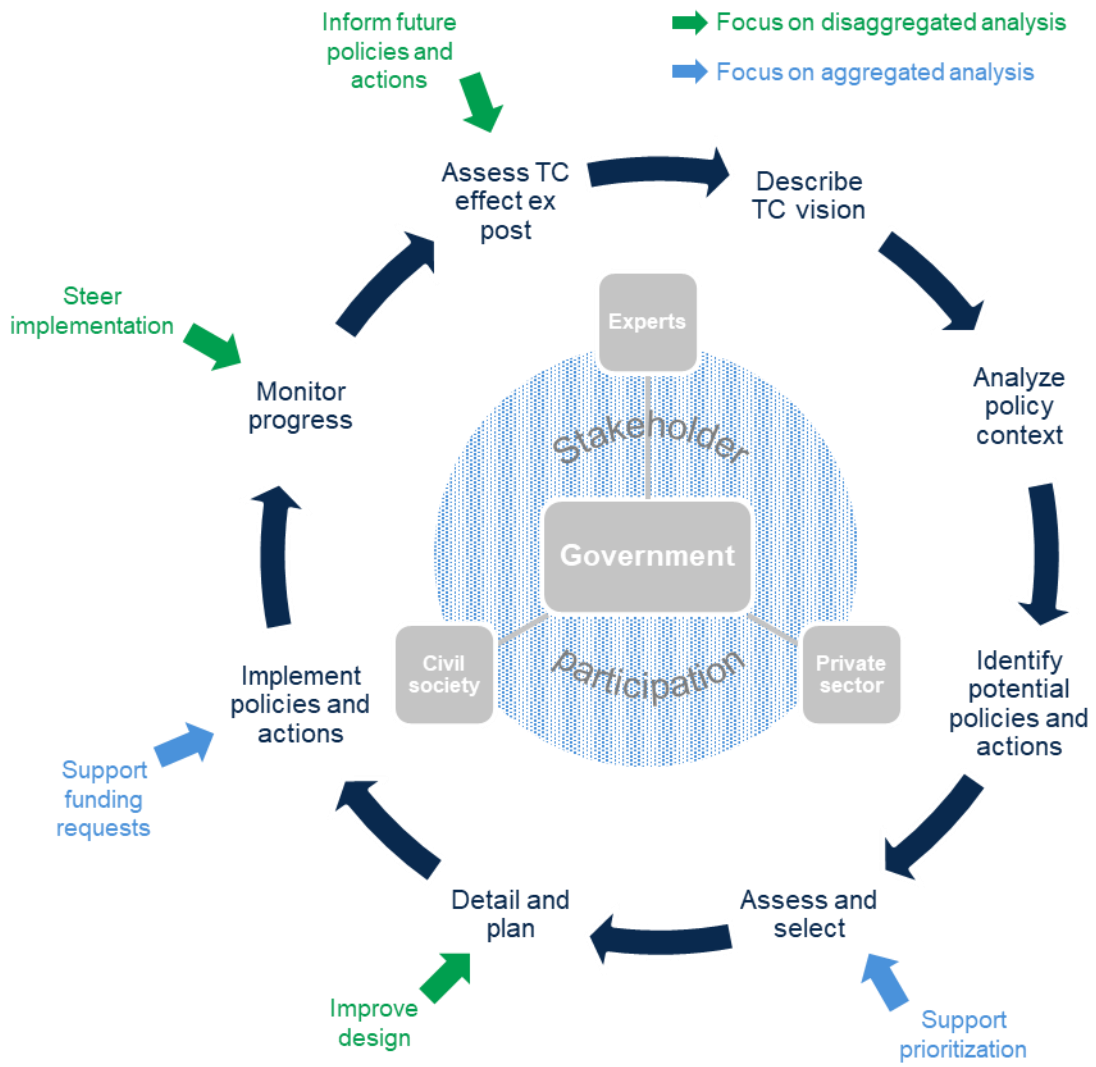
- The objective of the assessment
- The status of the policy or action in the implementation cycle

It is a *key recommendation* to describe insights gained from the assessment, and how results are used to revise objectives, design, planning and implementation of ongoing or future policies and actions.

The assessment will either be carried out by the entity (or entities) that is also planning and implementing the policy or action (or commissioned by this entity), or by an independent user not responsible for policy implementation. Independent users could for example be research organizations, private consultants or civil society groups. The objectives of assessing a policy or action at the various stages of implementation may differ between these two groups. The usefulness of more or less aggregate results for independent assessments will strongly depend on the objective of the assessment. In the following we therefore concentrate on the usefulness of results for those entities planning and implementing the assessed measures.

Figure 12.1 illustrates when aggregated results (e.g., at category level) versus disaggregated results (e.g., at characteristic level) are useful to consider in the policy implementation cycle. Refer to Chapter 6, Figure 6.2 for an illustration of the levels (characteristic, category and type) for assessment of transformational impact.

Figure 12.1: Usefulness of transformational change assessment at different stages of policy planning and implementation



Support prioritization and inform policy design options

An aggregated result describes the extent of transformation expected or achieved by the policy or action as well as how likely it is that the impact can be achieved. This enables comparison and prioritization of policy options early in the implementation cycle. However, users should exercise great caution in comparing results, and ensure that the methodology applied and choices made to assess various policies do not render the results incomparable. Further, transformational change assessment is likely to be one among many factors (such as resources needed, effects on stakeholders, sustainable development benefits) considered in decision making.

Disaggregated results are more useful to support the design of policies and actions. The greater level of detail can indicate areas of weaknesses and whether barriers are adequately addressed in policy design.

Support funding requests to attract finance

Both aggregated and disaggregated results can support funding requests to potential donors and make the case for the proposed intervention. It is important to note, however, that individual donor organizations may have a different definitions and criteria for transformational change from the one used in this methodology document. At the same time, there is sufficient flexibility in the methodology to enable users to utilize the results for various purposes.

Steer implementation and inform future policies

Detailed results from assessment conducted during implementation help to understand if the policy or action is on track, allow for course modifications as needed, instead of ending potentially transformative policies too soon and address new barriers or those that may have been overlooked in the design stage. Disaggregated level information from ex-post assessment can also inform the design of future policies and actions, including informing updates of NDCs or long-term strategies and plans by providing valuable insights on what worked and reasons for not achieving the desired impact. Ex-post assessment can thus contribute significantly towards future planning. Box 12.1 provides a case study example on how applying the ICAT Transformational Change Methodology can contribute to learning and improved policy design.

Box 12.1: Learning from transformational impact assessment in Mexico

In Mexico, the Grupo Ecológico Sierra Gorda, a national NGO, is coordinating the implementation of the Nationally Appropriate Mitigation Action (NAMA) of “Subnational Mitigation Actions for the Regeneration of Landscapes”. The NAMA involves state-led actions for the regeneration of forests and the implementation of planned grazing in 12 states.

The initial decision of the Grupo Ecológico to apply the ICAT Transformational Change Methodology was prompted by its interest in submitting a funding proposal to an international donor that prioritizes the funding of NAMAs that catalyze transformational change towards sustainable low-emission development. With limited prior experience with the theory and literature of transformational change, the Grupo Ecológico found that the process of evaluating the potential for transformational change with the ICAT guidance document to be a learning experience. It helped to improve the design of the NAMA and articulate more clearly the expected transformational impacts of the NAMA to potential supporters and donors.

Concrete examples of resulting improvements to NAMA design included a specific objective for the regenerative reorientation of the system of government programs, technical support, incentives and finance mechanisms for the target sectors; the formation of a critical mass of public officials decision makers, NGOs, educators, technicians and producers committed to regenerative management; the incorporation of a public awareness campaign in key cities; and a new integrated landscape management orientation for the NAMA with greater emphasis on intersectoral coordination and the clustering of interventions geographically in high-priority landscapes. This new orientation resulted in the current name of the NAMA.

APPENDIX A: EXAMPLES OF INDICATORS FOR PROCESS AND OUTCOME CHARACTERISTICS

This appendix provides examples of indicators for various process and outcome characteristics.

Table A.1: Examples of outcome indicators

Category	Characteristics	Indicators	References
Scale of outcome – GHG and sustainable developme nt together	Macro level	• Share of total GHG emission reductions or removals globally, regionally, by sector or subsector • Achievement of global Sustainable Development Goals in percentage • Share of zero carbon emissions in electricity generation compared to global best practices • Average total emissions per KWh • Change in renewable energy use (e.g., solar or wind) X times compared to the starting situation • Phase out of coal – number (and quantum) of new investments in coal plants • Phase out of fossil fuel - number (and quantum) of new investments in fossil fuel plants; in fossil fuel exploration and extraction • Share of RE (solar, wind, etc.) in generation mix • New investments in RE by technology • RE installed capacity (MW) and associated costs ($/MW installed) • RE net generation (kWh) • Emissions abated in the energy sector (tCO_2e) (compared to business as usual) • Emissions intensity in the energy sector (gCO_2e/kWh) • Energy intensity of the economy (kJ/GDP) • Emissions intensity of the economy (tCO_2e/GDP) • Cost of electricity from RE sources by technology ($/kWh) • Energy access (number of households/people with access to electricity/improved access) • Avoided energy demand 'megawatt' (MW) • CO_2e emissions from nitric acid plants	• IEA. 2017. *Metrics for energy sector decarbonisation 2015*. Available at: https://www.iea.org/etp/tracking2015/figures/metrics/ • UN. 2016. *Final List of Proposed Sustainable Development Goal Indicators*. Available at: https://unstats.un.org/sdgs/iaeg-sdgs/report-iaeg-sdgs/. • Westphal, M., and J. Thwaites. 2016. *Transformational Climate Finance: An Exploration of Low-Carbon Energy*. • Vieweg, M., & Noble, I. 2013. *Options for Resource Allocation in the Green Climate Fund (GCF)*. Incentivizing Paradigm Shift Within the GCG Allocation Framework. Background Paper 2.

		• Number of plants equipped with N_2O abatement technology	
	Medium level	• Achievement of national Sustainable Development Goals in percentage • Limits to growth of final energy use in the sector or subsector targeted to X% compared to the starting situation • Capacity share of zero carbon emissions • Subsector energy intensity • Final energy fuel share by sector or subsector • Phase out of coal - number (and quantum) of investments in new coal plants • Phase out of fossil fuel - number (and quantum) of new investments in fossil fuel plants; in fossil fuel exploration and extraction • Share of RE (solar, wind, etc.) in national generation mix • New investments in RE by technology (country or state) • RE installed capacity (MW) and associated costs ($/MW installed) • Renewable energy net generation (kWh) • Emissions abated in the energy sector (tCO_2e) (compared to business as usual) • Emissions intensity in the energy sector (gCO_2e/kWh) • Energy intensity of the economy (kJ/GDP) • Emissions intensity of the economy (tCO_2e/GDP) • Cost of electricity from RE sources by technology ($/kWh) • Energy access (number of households/people with access to electricity/improved access) • Avoided energy demand ‘megawatt’ (MW) • GHG impacts (tCO_2e) of NAMA by sector • GHG impacts as percentages of NDC sectoral goals • Value of economic and environmental returns by sector • CO_2e emissions from nitric acid plants • Number of plants equipped with N_2O abatement technology (taking into account	Same as above

		plant capacity and abatement efficiency of the chosen catalyst)	
	Micro level	• Achievement of subnational or local sustainable development targets • New-build emissions intensity • Equipment energy performance • Per capita energy use and emissions intensity • Passenger energy use and emissions intensity • Phase out coal - number of investments in new coal plants • Phase out fossil fuel - number (and quantum) of new investments in fossil fuel plants; in fossil fuel exploration and extraction • Number of households with solar home systems • New investments in RE by technology • Number of households/people with access to electricity/improved access (energy access) • GHG impacts (tCO_2e) of NAMA, average per state • Value of economic and environmental returns, average by state • CO_2e emissions from nitric acid plants • Number of plants equipped with N_2O abatement technology (taking into account plant capacity and abatement efficiency of the chosen catalyst)	Same as above
Outcome sustained over time – GHG and sustainable developme nt together	Long-term	• By 2100 phase out of all fossil fuels • By 2050 phase out of coal plants • Long-term RE goals • Sustainable development benefits by 2050 (disaggregated by sustainable development impacts) • GHG impacts (tCO_2e) over a long-term period (e.g., 2029-2040) • Value of economic and environmental returns over a long-term period (e.g., 2029-2040) • CO_2e emissions from nitric acid plants	Same as above
	Medium term	• By 2030 achieve the global and national Sustainable Development Goals	Same as above

		• By 2030 phase out of X% of coal plants • Accelerate energy efficiency by limiting growth of final energy use in the sector or subsector targeted to X% by 2030 compared to the starting situation • GHG impacts (tCO_2e) over a medium-term period (e.g. 2019-2028) • Value of economic and environmental returns over a medium-term period (e.g., 2019-2028) • Number of plants equipped with N_2O abatement technology	
	Short term	• By 2020 achieve X% of the Sustainable Development Goals • By 2020 phase out of X% of coal plants • Accelerate energy efficiency by limiting growth of final energy use in the sector or subsector to X% by 2020 compared to the starting situation • GHG impacts (tCO_2e) in the short-term (e.g., 2015-2018) • Value of economic and environmental returns in the short-term (e.g., 2015-2018)	Same as above

Table A.2: Examples of process indicators

Category	Characteristics	Indicators	References
Technology	Research and development	• R&D investments/funding • Patents registered (applied) • Number of centres, think tanks, or institutes of learning • Number of trainings, rate of participation • Number of new testing/Lab facilities • Number of new business models with an element of innovation • Number of states that integrate the technological package in subnational actions	• Bergek, A., Jacobsson, S., Carlsson, S., Lindmark, S., and Rickne, A. 2008. *Analyzing the functional dynamics of technological innovation systems: A scheme of analysis.* Research Policy, (37), 3, 407-429 • Laursen, K., & Salter, A. 2004. *Searching high and low: what types of firms use universities as a source of innovation?* Research policy, 33(8), 1201-1215.
	Adoption	• Number of new businesses/start-ups • Number of new business models • Number of product or process innovations • Documented examples of incremental and radical innovations	• OECD. 2005. *Oslo Manual, Guidelines for collecting and interpreting Innovation data, 3rd Edition*. Organization for Economic Cooperation and Development (OECD), Paris. • Fageberg, J. 2005. *Innovation: A guide to the Literature*. in Fagerberg, J., et al. (eds.) The

		• Number of awards for innovation development • Number of subnational actions for forest regeneration • Number of subnational actions for the implementation of planned grazing	Oxford Handbook of Innovation, Oxford University Press, Oxford.
	Scale up	• Number of workshops, platforms for knowledge sharing among industry associations etc. • Number of new demonstration projects initiated • Number of projects replicating state-of-the-art technology (ongoing) • Number of projects implemented (with economies of scale) • Number of government services to support adoption of new technologies • Number of forest properties that implement regenerative actions as part of subnational actions • Number of ranches that implement planned grazing as part of subnational actions • Ratio of plants with abatement technology and monitoring equipment to the total number of plants (including those without such equipment) within a country	• Nygaard, I., & Hansen, U. 2015. *Overcoming Barriers to the Transfer and Diffusion of Climate Technologies*. 2nd ed. UNEP DTU Partnership. TNA Guidebook Series • Nemet, G. 2009. *Demand-pull, technology-push, and government-led incentives for non-incremental technical change*. Research Policy, 38, 700–709 • Michael, P. Schneider, M., Griesshaber, T., Hoffmann, V. 2012. *The impact of technology-push and demand-pull policies on technical change – Does the locus of policies matter?* Research Policy, 41(8), 1296–1308.
Agents	Entrepreneurs	• Number of new entrepreneurs and new entrants in the low carbon sectors • Provision of training in entrepreneurship • Incentives provided for new entrepreneurs (subsidies, seed funding for SMEs, research support etc.) • Number of PPP projects • Volume of venture capital investments • Share of private funding and public funding • MOUs signed, projects under pipeline • New models of partnerships formed with government/firms and donors	• Langevang, T., Namatovu, R. and Dawa, S. 2012: *Beyond necessity and opportunity entrepreneurship: motivations and aspirations of young entrepreneurs in Uganda, International Development Planning Review*. 34(4), 242-252. • Kemp. R., Schot, J., Hoogma, R., 1998. *Regime Shifts to Sustainability Through Processes of Niche Formation: The Approach of Strategic Niche Management*. Technology Analysis and Strategic Management 10, 175-195

		• Entrepreneurs trained for regenerative management	
	Coalitions of advocates	• Trade expos, business shows, workshops, conferences, seminars • University-industry collaboration • Number of linkages across research institutions • Research grants and research projects • Consultancy projects • Industry associations created to enhance firm cooperation • Number of lobby groups (organizations or committees that are committed to low carbon development and have been established or significantly strengthened/actively lobbies for changes) • Number of advocacy programs, campaigns and initiatives • Civil society organizations denouncing unsustainable, high-carbon practices and behaviour • Community surveys/preferences denouncing the outreach of unsustainable practices • Number of leaders, authorities bringing up/ promoting/ demonstrating zero-carbon development practices and changed behavior • Number of civil society organizations that collaborate with subnational actions of a NAMA • Number of exchanges or meetings between an initiative's members (e.g., between NACAG members - governmental level or plant operators) and key actors not directly involved in the initiative, such as the World Bank carbon market programme and labelling initiatives, who could influence all developing country players to take action	• Lundvall, B. (ed.) 1992. *National Innovation Systems: Towards a Theory of Innovation and Interactive Learning*. Pinter, London. • Hekkert, M., Negro, S., Heimeriks, G., & Harmsen, R. 2011. *Technological innovation system analysis*. Faculty of Geosciences Utrecht University • Kebede, K., Mitsufuji, T., Choi, E. 2014. *Looking for innovation system builders: A case of Solar Energy Foundation in Ethiopia*. African J. Sci. Technol. Innov. Dev. 6, 289–300. • Ockwell, D., Byrne, R., 2015. *Improving technology transfer through national systems of innovation: climate relevant innovation-system builders (CRIBs)*. Clim. Policy 1–19 • Hellsmark, H., Jacobsson, S., 2009. *Opportunities for and limits to Academics as System builders- The case of realizing the potential of gasified biomass in Austria*. Energy Policy 37, 5597–5611. • NAMA Facility Monitoring and Evaluation Guidance Methodology for NAMA Support Projects (Sep 2015), Annex 4
	Beneficiaries	• Number of grassroot campaigns in favor of low carbon practices • Number of owners and holders of forest lands and grazing lands that implement regenerative practices	

		• Number of governments that get involved with an initiative and support its vision (e.g., signatories of a joint declaration of support) • Number of plants that get involved with an initiative and support its vision	
Incentives	Economic and non-economic incentives	• New subsidies, tariff structures such as renewable energy obligations, feed-in tariffs, renewable energy auctions, VAT exemption • New MOUs signed • New projects under pipeline • New models of partnerships formed with government/firms and donors (i.e., models that create access to resources and services thus incentivizing conscious behaviour towards resource use) • Number of financing mechanisms that encourage the regenerative actions of a landscape regeneration NAMA • Number of economic and non-economic incentives in place at the national level	• Johnstone, N., Haščič, D. Popp, D. 2010. *Renewable Energy Policies and Technological Innovation: Evidence Based on Patent Counts*. Environmental and Resource Economics, 45(1), 133–155. • Butler, L. & Neuhoff, K. 2008. *Comparison of feed-in tariff, quota and auction mechanisms to support wind power development*. Renewable Energy, 33(8), 1854–1867. • Norberg-Bohm, V. 2000. *Creating incentives for environmentally enhancing technological change: lessons from 30 years of US energy technology policy*. Technological forecasting and social change, 65(2), 125-148. • Westley, F., Olsson, P., Folke, C., Homer-Dixon, T., Vredenburg, H., Loorbach, D., & Banerjee, B. 2011. *Tipping toward sustainability: emerging pathways of transformation*. Ambio, 40(7), 762-780 • Painuly, P. (2001) Barriers to renewable energy penetration; a framework for analysis. Renewable Energy, 24, 73–89. • Gallastegui, i. 2002. *The use of Eco-labels: a review of the literature*. European Environment 12, 316–331. • Kiss, B., Manchón, C. & Neij, L. 2013. *The role of policy instruments in supporting the development of mineral wool insulation in Germany, Sweden and the United Kingdom*. Journal of Cleaner Production, 48, 187–199.
	Disincentives	• Disincentives provided via carbon pricing/tax, increase in petrol/diesel prices, car registration tax etc. • Number of counterproductive subsidies eliminated	• Wesselink, J., Niesten, E., Faber, J., Hekkert, M. 2013. *Business Strategies of Incumbents in the Market for Electric Vehicles: Opportunities and Incentives for Sustainable Innovation*. Business

		• Number of national policies that create a disincentive for unabated N_2O emissions	Strategy and the Environment, 24, 518–531. • Hansen, T. & Coenen, L. 2016. *Unpacking resource mobilisation by incumbents for biorefineries: the role of micro-level factors for technological innovation system weaknesses*, Technology Analysis and Strategic Management, forthcoming.
	Institutional and regulatory	• Number of new regulations and institutions to promote low carbon practices • Number of subnational actions for forest regeneration • Number of subnational actions for the implementation of planned grazing • Number of regulations or policies in place at the national level	
Norms	Awareness	• Number of open debates/ statements/publications highlighting the insufficiency of current practices • Number of leaders/organizations pushing/heading debates questioning current practices and pathways and lobbying for behavioural change • Number of information workshops and such platforms • Number of awareness generation programs through private sector or business associations etc. • Number of initiatives targeting public opinion in ethical and moral issues (e.g., agenda setting) • Number of awareness campaigns • Number of governments that understand the potential of the nitric acid sector for climate protection measured through, for example, awareness raising activities such as communication materials or events held • Actions undertaken as a result of enhanced awareness among government officials	• Nygaard, I., & Hansen, U. 2015. *Overcoming Barriers to the Transfer and Diffusion of Climate Technologies*. (2nd ed.) UNEP DTU Partnership. TNA Guidebook Series • Wüstenhagena, R., Wolsink, M., Bürera, M. 2007. *Social acceptance of renewable energy innovation: An introduction to the concept*. Energy Policy, 35(5), 2683–2691.

	Behaviour	• New government persuasion programs, appealing to the collective conscious through the medium of advertising • New government enforcement programs and initiatives compelling behavior change • Policies targeting change in the norms and rules (e.g., dynamic pricing regulation) • Number of young leaders trained (future generation to keep momentum and sustained change and even 'more' change in case necessary) • Number of leadership awards announced for public demonstration of changed behaviour • Number of governmental agents/services supporting the adoption of new technologies and changed behaviour • Number of owners and trained owners	• McAdams, R. H. 1997. *The origin, development, and regulation of norms*. Michigan Law Review, 96(2), 338-433. • Shove, E. (2003). Converging conventions of comfort, cleanliness and convenience. Journal of Consumer policy, 26(4), 395-418. • Lapinski, M. K., & Rimal, R. N. 2005. *An explication of social norms*. Communication Theory, 15(2), 127-147. • Kinzig, A. P., Ehrlich, P. R., Alston, L. J., Arrow, K., Barrett, S., Buchman, T. G., ... & Ostrom, E. 2013. *Social norms and global environmental challenges: the complex interaction of behaviours, values, and policy*. BioScience, 63(3), 164-175.
	Social norms	• New regulatory standards (e.g., mandatory emission levels) • New laws making previous behaviour illegal • Number of users affected • Services affected (e.g., energy savings, change in public • Checks and balances introduced to prevent fallbacks into previous practices and behavior • Number of awareness campaigns	• Barbu, A., Griffiths, N., & Morton, G. 2013. *Achieving energy efficiency through behaviour change: what does it take?* European Environment Agency-Copenhagen: Publications Office of the European Union. • Ambec, S., Cohen, M., Elgie, S., Lanoie, P. 2013. *The Porter Hypothesis at 20: Can Environmental Regulation Enhance Innovation and Competitiveness?* Rev Environ Econ Policy, 7(1), 2-22. • Maia David, M., Sinclair-Desgagné, B. 2005. *Environmental Regulation and the Eco-Industry*. Journal of Regulatory Economics 28(2), 141–155.

APPENDIX B: STAKEHOLDER PARTICIPATION DURING THE ASSESSMENT PROCESS

This appendix provides an overview of the ways that stakeholder participation can enhance the assessment of transformational impacts of policies and actions. Table B.1 provides a summary of the steps in the assessment process where stakeholder participation is recommended and why it is important, explaining where relevant information can be found in the ICAT *Stakeholder Participation Guide*.

Table B.1: List of steps where stakeholder participation is recommended in transformational impact assessment

Chapter/step in this document	**Why stakeholder participation is important at this step**	**Relevant chapters in *Stakeholder Participation Guide***
Chapter 2 – Objectives of assessing transformational change	• Ensure that the objectives of the assessment respond to the needs and interests of the stakeholders	Chapter 5 – Identifying and understanding stakeholders
Chapter 4 – Steps and assessment principles • Section 4.1.1 Overview of steps - planning the assessment	• Build understanding, participation and support for the policy or action among stakeholders • Ensure conformity with national and international laws and norms, as well as donor requirements related to stakeholder participation • Identify and plan how to engage stakeholder groups who may be affected or may influence the policy or action • Coordinate participation at multiple steps for this assessment with participation in other stages of the policy design and implementation cycle and other assessments	Chapter 4 – Planning effective stakeholder participation Chapter 5 – Identifying and understanding stakeholders Chapter 6 – Establishing multi-stakeholder bodies Chapter 9 – Establishing grievance redress mechanisms
Chapter 5 – Describing the policy or action and the transformational change vision • Section 5.2 Describe the vision for transformational change of a policy or action	• Reflect diverse stakeholder interests and concerns in the vision for transformational change	Chapter 5 – Identifying and understanding stakeholders Chapter 6 – Establishing multi-stakeholder bodies/structures
Chapter 6 - Choosing which transformational change characteristics to assess • Section 6.33 Choosing transformational change	• Enhance completeness of identification of transformational change characteristics with stakeholder insights	Chapter 8 – Designing and conducting consultations

characteristics to be assessed	• Ensure indicators and frequency of monitoring reflect stakeholder interests and information needs	
Chapter 7 – Assessment of the starting situation • Section 7.2 Identify barriers to transformational change	• Improve identification of barriers to transformational change with stakeholder insights	Chapter 8 – Designing and conducting consultations
Chapter 8 – Estimating transformational impacts ex-ante • Section 8.1 Assess barriers • Section 8.2 Assess characteristics	• Improve identification of barriers to transformational change with stakeholder insights • Minimize subjectivity and bias by integrating diverse stakeholder insights on estimated future changes of transformational characteristics	Chapter 5 – Identifying and understanding stakeholders Chapter 6 – Establishing multi-stakeholder bodies/structures Chapter 8 – Designing and conducting consultations
Chapter 9 – Estimating transformational impacts ex-post • Section 9.2 Assess characteristics	• Improve scoring of changes in transformational characteristics with stakeholder insights	Chapter 8 – Designing and conducting consultations
Chapter 10 – Monitoring performance over time • Section 10.1 Define the monitoring period and frequency • Section 10.3 Monitor indicators over time	• Ensure monitoring frequency addresses the needs of decision makers and other stakeholders • Ensure relevance and completeness of indicators to be monitored	Chapter 5 – Identifying and understanding stakeholders Chapter 8 – Designing and conducting consultations
Chapter 11 – Reporting	• Inform decision makers and other stakeholders about transformational impacts • Increase accountability and transparency and thereby credibility and acceptance of the assessment	Chapter 7 – Providing information

ABBREVIATIONS AND ACRONYMS

EU	European Union
GHG	greenhouse gas
ICAT	Initiative for Climate Action Transparency
IPCC	Intergovernmental Panel on Climate Change
NDC	Nationally Determined Contribution
NGO	non-governmental organization
MRV	Measurement, Reporting and Verification
PV	photovoltaic
R&D	research and development
RD&D	research, development and deployment
SDG	Sustainable Development Goal
SMART	specific, measurable, achievable, realistic, time-bound
SSSMART	scale, sustained nature, specific, measurable, achievable, realistic, time-bound
USD	United States Dollars
UNFCCC	United Nations Framework Convention on Climate Change
WRI	World Resources Institute

GLOSSARY

Assessment boundary	The scope of the assessment in terms of the range of transformational change characteristics that are included in the assessment and the geographical and sectoral coverage of the assessment
Assessment period	The time period over which transformational change impacts attributed to the policy or action are assessed. The assessment period can differ from the policy or action implementation period (the time period over which the policy or action is being executed) and the wider transformational change period (both historical and future changes)
Assessment report	A report, completed by the user, that documents the assessment process and the GHG, sustainable development and/or transformational impacts of the policy or action
Bottom-up data	Data that are measured, monitored, or collected at the facility, entity or project level
Bottom-up methods	Methods (such as engineering models) that calculate or model the impact of the policy or action for each facility, project, or entity affected by the policy or action, then aggregate across all facilities, projects, or entities to determine the total impact of the policy or action
Category of transformational change	A group of transformational characteristics that describe processes of change (technology, agents, incentives and norms) and outcomes of change (scale of outcome and sustained nature of outcome)
Characteristic of transformational change	An element or property of a system undergoing a transformation. A policy or action can result in changes of characteristics describing a system that lead to process of change and outcomes of change.
Ex-ante assessment	The process of assessing expected future transformational change impacts of policies and actions (i.e., a forward-looking assessment)
Expert judgment	A carefully considered, well-documented qualitative or quantitative judgment made in the absence of unequivocal observational evidence by a person or persons who have a demonstrable expertise in the given field (IPCC 2006).
Ex-post assessment	The process of assessing historical transformational change impacts of policies and actions (i.e., a backward-looking assessment)
Impact assessment	The qualitative or quantitative assessment of transformational impacts resulting from a policy or action, either ex-ante or ex-post

Impact type	A result of transformational change that describe the process of change and the outcome of change
Implemented policies	Policies and actions that are currently in effect, as evidenced by one or more of the and actions following: (a) relevant legislation or regulation is in force, (b) one or more voluntary agreements have been established and are in force, (c) financial resources have been allocated, or (d) human resources have been mobilized
Indicator of transformational change	For qualitative assessment: a variable that can be assessed to indicate the impact of the policy or action on a given characteristic of transformational change. For quantitative assessment: a metric that can be estimated or measured to indicate the impact of a policy or action on a characteristic of transformational change.
Monitoring period	The time over which the policy is monitored, which may include pre-policy monitoring and post-policy monitoring in addition to the policy implementation period
Outcome of transformational change	A transformational outcome is the change in GHG emission reductions and sustainable development impacts at scale and sustained over time resulting from a policy or action
Phase of transformation	A stage in the historical development of a system that undergoes an innovation and social transition process. Generic phases are pre-development, take-off, acceleration and stabilization or relapse.
Planned policies and actions	Policy or action options that are under discussion and have a realistic chance of being adopted and implemented in the future but that have not yet been adopted or implemented
Policy or action	An intervention taken or mandated by a government, institution, or other entity, which may include laws, regulations, and standards; taxes, charges, subsidies, and incentives; information instruments; voluntary agreements; implementation of new technologies, processes, or practices; and public or private sector financing and investment, among others.
Policy implementation period	The time period during which the policy or action is in effect
Process of transformational change	A series of events describing how elements or characteristics of a system interact and change to reconfigure a system. Elements of a transformational change process are technology, agents, incentives and norms.
Stakeholders	People, organizations, communities or individuals who are affected by and/or who have influence or power over the policy
Starting situation	The current situation of a selected historical year before implementation of a policy or action that describes the phase of

	transition and the status of selected indicators as a benchmark to track performance against
Sustainable development impacts	Changes in environmental, social, or economic conditions that result from a policy or action, such as changes in economic activity, employment, public health, air quality, gender equality and energy security
System	A configuration of social and technical elements (characteristics of transformational change) forming a complex whole across three levels of society; micro, medium and macro
Top-down data	Macro-level statistics collected at the jurisdiction or sector level, such as energy use, population, GDP, or fuel prices
Top-down methods	Methods (such as econometric models or regression analysis) that use statistical methods to calculate or model changes in GHG emissions
Transformational change	A fundamental, sustained change of a system that disrupts established high-carbon practices and contributes to a zero-carbon society in line with the Paris Agreement's 1.5-2 °C temperature goal and the UN Sustainable Development Goals
Transformational impact	Changes in system characteristics resulting from a policy or action described by processes and outcomes of transformational change with regard to greenhouse gas and sustainable development impacts at scale and sustained over time

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