United Nations
Framework Convention on
Climate Change

TEC Brief

Technology Executive Committee

Using roadmapping to facilitate the planning and implementation of technologies for mitigation and adaptation

Why this TEC Brief?

Policymakers in developing countries, and other related stakeholders, have at their disposal various planning tools for developing and implementing policies and measures for the development and transfer of environmentally sound technologies. One of these tools is technology roadmaps (TRMs).

This TEC Brief is aimed at informing national level decision makers in charge of mitigation and adaptation processes about the benefits of using a roadmapping approach in order to facilitate the planning and implementation of technologies. It presents the findings of an empirical analysis of existing TRMs, conducted by the Technology Executive Committee (TEC), and identifies best practices, which could be easily incorporated by Parties into existing planning documents, including technology action plans (TAPs), nationally appropriate mitigation actions (NAMAs) and national adaptation plans (NAPs). The use of a roadmapping approach could enhance action on the development and transfer of technologies for mitigation and adaptation.

Roadmapping and other planning approaches under the UNFCCC

TAPs are planning documents which guide the implementation of the results of **Technology Needs Assessments (TNAs)**. TRMs could provide a ready-to-use structure for individual parts of TAPs, translating the outcomes of TNAs into concrete, time-related actions related to a selected group of technologies. Roadmapping techniques could be used in TAPs or accompany already prepared TAPs, specifying steps towards their desired implementation. Realistic and rigorous planning efforts are likely to increase the probability of funding for projects, as they convince potential investors and donors that the authors of a TAP understand the complexity of the processes for technology acquisition and implementation and that the national stakeholders are committed to the plan.

NAMAs and **NAPs** are policy documents which encompass actions which extend beyond the realm of climate technologies. TRMs offer clear benefits when specific technologies are being implemented to facilitate national efforts. More generally, roadmapping techniques support structured planning efforts, with specific actions, milestones and actors, thus complementing more generic strategies or policies.

Technology roadmap - definition

Roadmaps help identify policies and measures that are instrumental in supporting project implementation, and also identify and address specific challenges. Their contents can be regarded as the basis for good planning practices in various areas, including technology implementation to enhance mitigation and adaptation to climate change. Roadmaps could therefore be useful in other planning processes. The TEC members, experts and observers expressed the opinion that the process of developing roadmaps is as important as the tangible outcomes.

Do you have a good technology roadmap / technology action plan?

It should include:
- Common (preferably quantifiable) objectives;
- Time-specific milestones;
- A consistent set of concrete actions;
- Defined roles for the implementation of specific actions (including those of the stakeholders).

And:
- Be a coherent planning document;
- Relate to a selected category of technologies;
- Focus on stimulating implementation of these technologies;
- Result from co-operation or engagement with relevant stakeholders.

THE ROADMAPPING PROCESS INVOLVES:

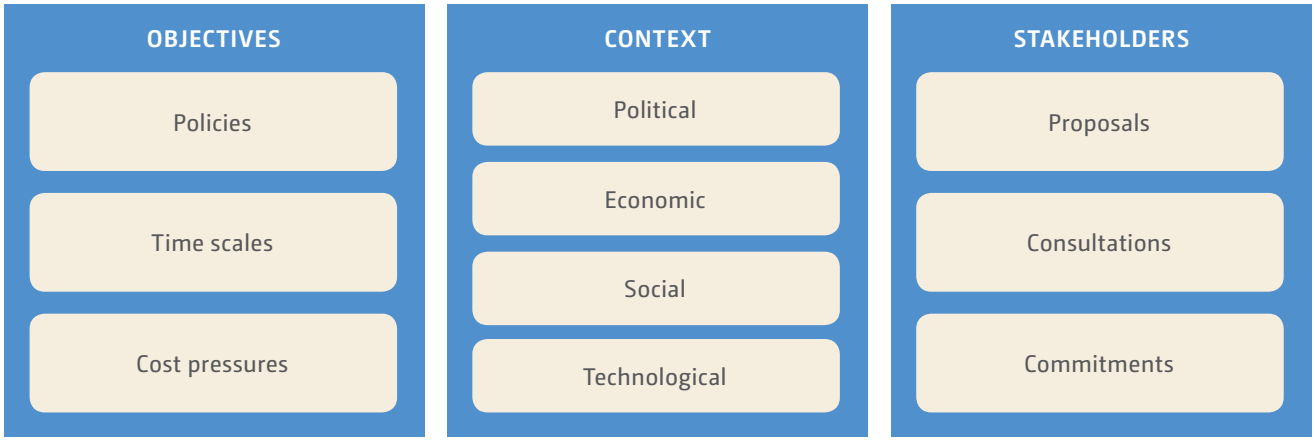
- ↳ Rigorous analysis of existing, relevant, empirical data;
- ↳ Increased communication with stakeholders, and consensus-building;
- ↳ A list of specific, time-related actions;
- ↳ Monitoring to help ensure that objectives are attained.

The roadmapping process belongs to a wide range of technology planning tools and practices. A TRM may relate to policy frameworks, support mechanisms for the implementation of specific technologies, as well as the development of markets, industries and underlying infrastructures. Some policy frameworks are descriptive, focusing on what we expect to happen (e.g. forecasts, scenario planning), and do not usually take into consideration possible interactions with technology users or the desirability of specific future developments.

Other frameworks, such as normative planning tools, outline what policymakers want to happen (e.g. visions, backcasting, foresights, sensitivity analysis), and include general outlines of a desirable future.

TRMs are normative planning tools that can be used to influence expected developments. They start with a view of a desirable future and include specific steps towards the successful implementation of necessary actions. Private sector TRMs are usually prepared by technology companies and focus on technology development and the introduction of new product generations. In contrast, public sector TRMs are linked to technology diffusion, including the necessary adjustments of existing technologies to local conditions. They consider multiple existing technological options to best address specific gaps and scope the desired implementations. Public sector TRMs relate to a broad category of technologies, including multiple alternatives, not merely one specific technology variant.

Roadmapping - specific actions shaping the future



The TEC's background paper on technology roadmaps outlined **the following key purposes of TRMs**:

1) To provide coherent input to (inter)national technology R&D policy;
2) To provide a basis for national policy supporting the diffusion of technologies for adaptation and mitigation;
3) To act as a catalyst for existing technologies to adapt to new markets;
4) To mobilize private sector interest in climate technologies;
5) To provide a common platform for international support;
6) To (generally) align actions of different funders and governmental institutions.

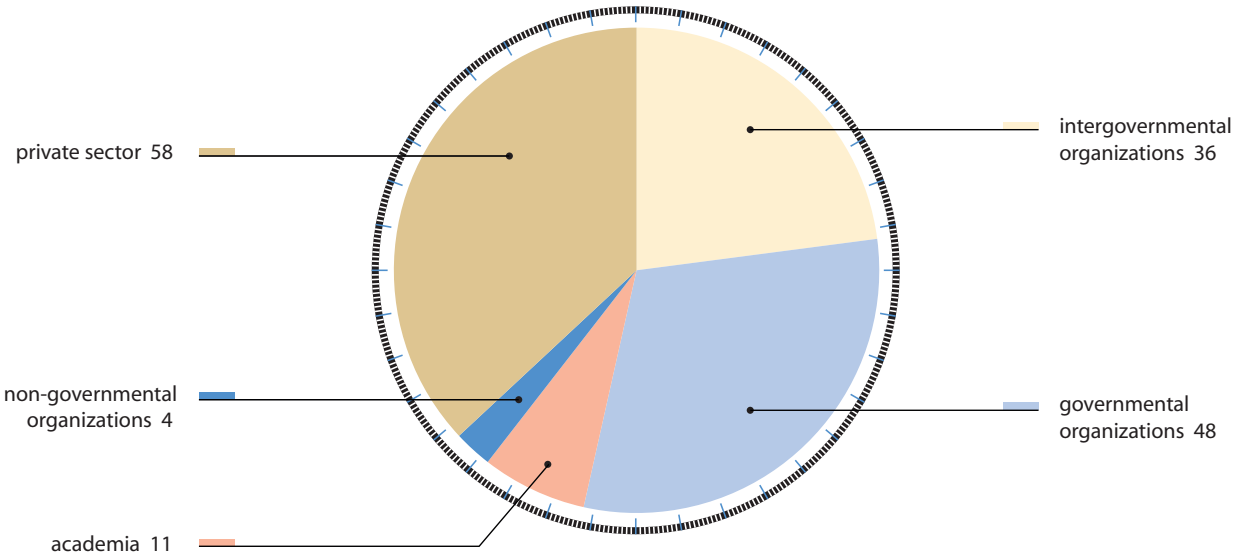
Participants of the TEC expert meeting on technology roadmaps identified **the following key benefits of TRMs.** TRMs:

1) Engage stakeholders, including the private sector;
2) Are demand-driven and therefore adjustable to national or regional circumstances;
3) Are knowledge-based;
4) Include priorities, timescales, ownership of solutions and costs;
5) Stimulate commitment and legitimacy of efforts;
6) Improve access to, and promote a better understanding of, existing technologies.

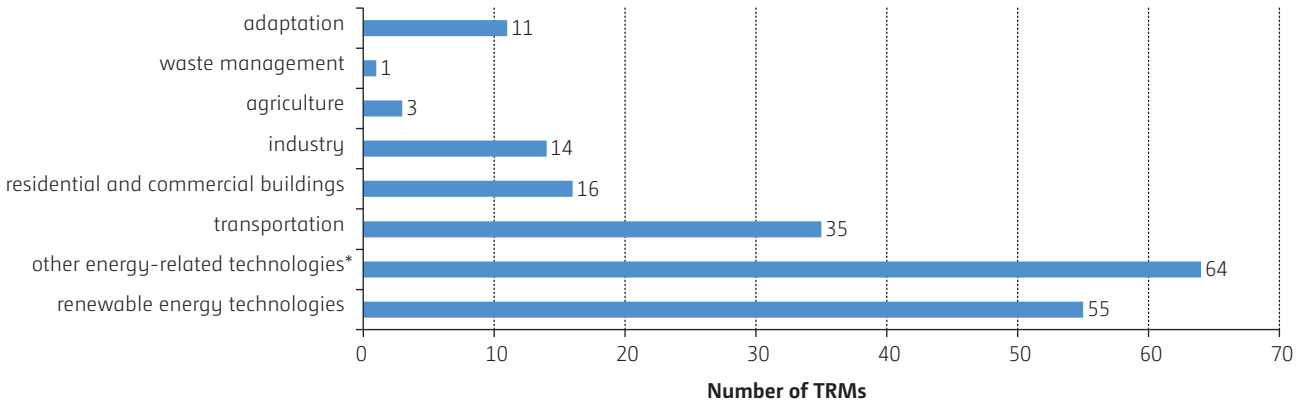
Existing technology roadmaps

Technology roadmapping is gaining in popularity and can now be directly linked to the existing planning frameworks under the United Nations Framework Convention on Climate Change (UNFCCC). In 2012, an analysis was conducted on behalf of the TEC of 159 English-language TRMs related to mitigation and adaptation technologies, which were available in the public domain. These TRMs are available as part of a TRM inventory found at the TT:CLEAR website (ttclear.unfccc.int), and the analytical results were published as a background paper on technology roadmaps. The analysis showed that the majority of existing TRMs focused on mitigation technologies and were prepared in developed countries. The analysis also identified gaps in planning the implementation of technologies for adaptation. Many TRMs were incomplete, lacking some important elements of a good practice roadmap (see the following section). The charts below classify authors, types of technologies and time periods covered by the TRMs included in the dataset analysed on behalf of the TEC.

Authors of technology roadmaps (number)

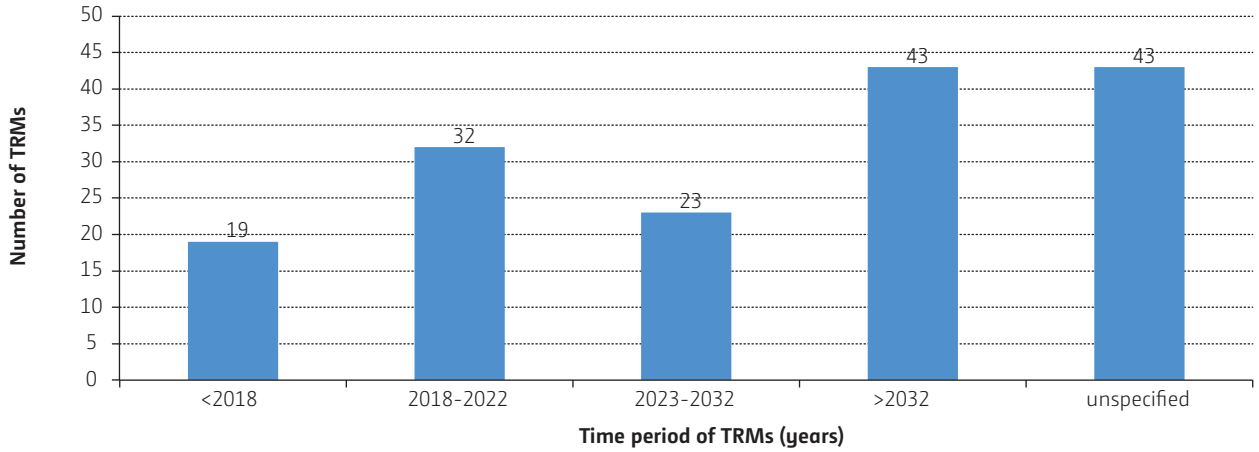


Technology types analysed in technology roadmaps



** Other energy-related technologies include, inter alia:* Carbon capture and storage, hydrogen fuel cells and energy storage and distribution.

Time horizon of technology roadmaps



Good planning practices

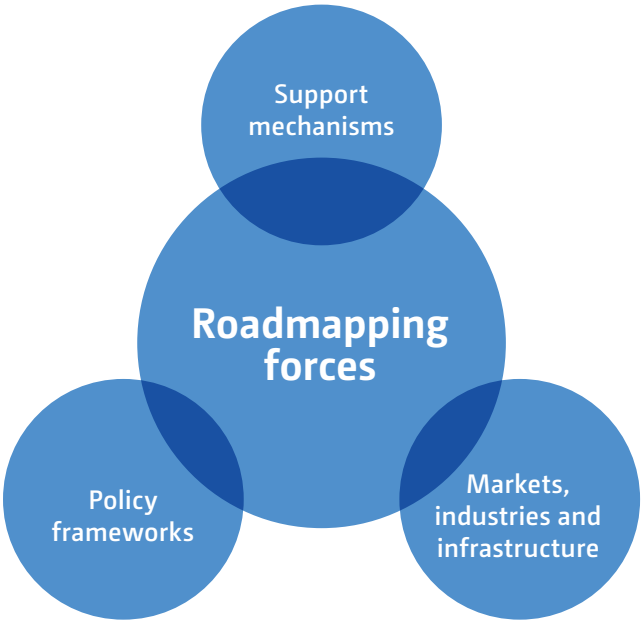
The analysis of existing TRMs helped identify examples of good practices and prepare recommendations for improving technology planning processes. These good practices ensured that plans were not merely wish lists or lists of priorities, but included detailed implementation steps, resulting from an understanding of the situation at the time and the specific local context.

	Good practice	Rationale
1)	**Define the specific objective for your technology initiative**	Make sure you know exactly what you are striving for.
2)	**Link the objective directly to the existing mitigation or adaptation efforts**	Avoid duplicating or fragmenting efforts. Verify if the proposed actions contribute to your climate change-related objectives.
3)	**Make the objective measurable**	Use quantifiable parameters to increase accountability, e.g. the amount of energy produced from a specific renewable source.
4)	**Outline the actions / milestones that are necessary to attain the objective**	Make the roadmap more practical by showing gradual progress from the current status to the desired outcome, and by demonstrating that specific actions are needed to attain your objective.
5)	**Make the objective and actions time-related**	Provide realistic timelines, with deadlines which stimulate implementation efforts.
6)	**Indicate the expected roles of specific stakeholders for each milestone**	Ensure the engagement of stakeholders and their willingness to support the implementation, make them responsible for specific actions.
7)	**Estimate resource requirements**	Make your roadmap realistic and legitimate, as specificity is likely to attract investors and donors.
8)	**Document the process used to develop your plan and utilize empirical data sources**	Make your plan credible and evidence-based.
9)	**Use visual schemes, outlining implementation milestones**	Use graphical presentation to help communicate your plan and streamline the proposed actions.

The successful implementation of technologies for mitigation and adaptation might require specific actions that extend beyond the acquisition of technology. These specific actions are outlined in the figure below and encompass policy frameworks, markets, industries, infrastructure and support mechanisms. Necessary actions, identified in the roadmapping process, often encompass new policies and measures which are to be developed. Examples could include proposals for government policy changes, new or amended legislation, as well as the introduction of government incentives such as subsidies, tax exemptions, the removal of import duties, setting technical standards and awareness campaigns.

Roadmapping forces

Technology planning relies on an assessment of the availability of, and associated requirements for, skilled personnel; implementation projects usually incorporate capacity-building components. Planners should also take into consideration actions addressing interrelated domains that enable the uptake of technologies. (For example, when new energy generation technologies are introduced, corresponding changes to infrastructure may be required with regard to the supply, storage or distribution of energy.) Other important actions relate to monitoring and documenting the results of technology projects and lessons learned, to share with stakeholders in order to stimulate further action.



Successful roadmapping requires a clearly defined and measureable objective. More TRMs exist for mitigation than for adaptation technologies (refer to the findings presented in the TEC "Background paper on technology roadmaps"), as emission reduction efforts are directly quantifiable, while adaptation is more context-specific, linked to local vulnerability assessments and resilience requirements. Public sector TRMs are best suited for guiding the implementation of existing technologies. Nevertheless, they could also be used to direct further developments of technologies, as long as the stakeholders involved in preparing and implementing a TRM have direct influence over these developments.

Lessons learned:

- Sound planning practices are essential for securing funding for technology development and transfer projects and ensuring their successful implementation.
- Technology roadmaps are prepared to speed up the diffusion of individual technologies. The development of roadmaps can help to meet national objectives related to mitigation and adaptation.
- The use of a roadmapping approach helps to improve the content of planning documents, including TAPs, NAMAs and NAPs, and can help Parties transform the results of TNAs into actions.
- The empirical analysis of existing TRMs revealed that there is only a limited number of roadmaps for adaptation technologies, and that this might prevent the successful implementation of adaptation projects.

Conclusions

TRMs are useful tools, offering synergies with other planning documents under the UNFCCC. The challenge that the global community needs to address as it responds to climate change is how best to utilize technology roadmaps as well as roadmapping knowledge and skills in order to optimally package and implement NAMAs and NAPs. This would help to effectively contribute to the reduction of global level greenhouse gas emissions and increase the resilience of communities and the Earth to the impacts of climate change.

Reference

- TEC Brief "Results and success factors of TNAs" (October 2013)
- TEC Brief "Possible integration of the TNA process with NAMA and NAP processes" (October 2013)
- Background paper on technology roadmaps. Technology Executive Committee, TEC/2013/5/5
- Handbook for conducting technology needs assessment for climate change. United Nations Development Programme (November 2010)
- Inventory of technology roadmaps available on the UNFCCC TT:CLEAR website (ttclear.unfccc.int)

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PHOTO CREDITS

PAGE 1 - UNFCCC, Photographer: Seleha Lockwood, CDM Project - 1900: Duerping Coal Mine Methane Utilization Project, China

PAGE 3 - UNFCCC, Photographer: Leandro Noel, CDM Project - 0968: Incomex Hydroelectric Project, Brazil

PAGE 5 - UNFCCC, Photographer: Tao Ketu, CDM Project - 2307: Federal Intertrade Pengyang Solar Cooker Project, China

About the Technology Executive Committee

The Technology Executive Committee (TEC) is the policy component of the Technology Mechanism established by the Conference of the Parties (COP) in 2010 by decision 1/CP.16 to facilitate the implementation of enhanced action on technology development and transfer to support action on mitigation and adaptation. Along with the Climate Technology Centre and Network, the other component of the Technology Mechanism, the TEC is mandated to facilitate the effective implementation of the Technology Mechanism.

The COP, by decision 1/CP.16, requested the TEC to catalyse the development and use of technology roadmaps or action plans at the international, regional and national level through cooperation between relevant stakeholders, particularly governments and relevant organizations or bodies, including the development of best practice guidelines as facilitative tools for action on mitigation and adaptation. In 2012-2013, the TEC established a dedicated task force dealing with technology roadmaps (TRMs), developed an inventory of existing roadmaps, prepared a background paper based on the analysis of the inventory and organized an expert meeting to gather opinions about existing and possible actions.