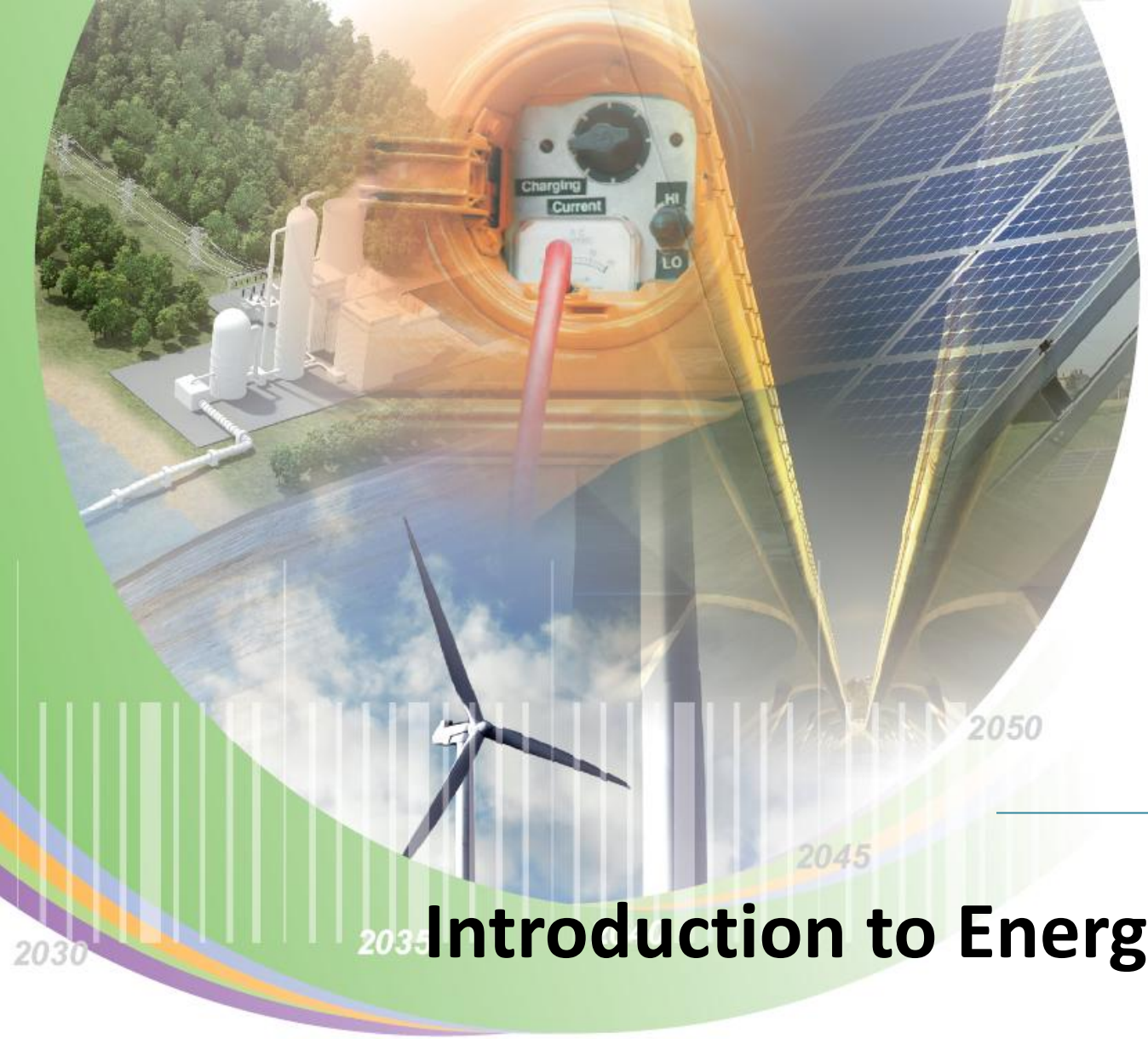
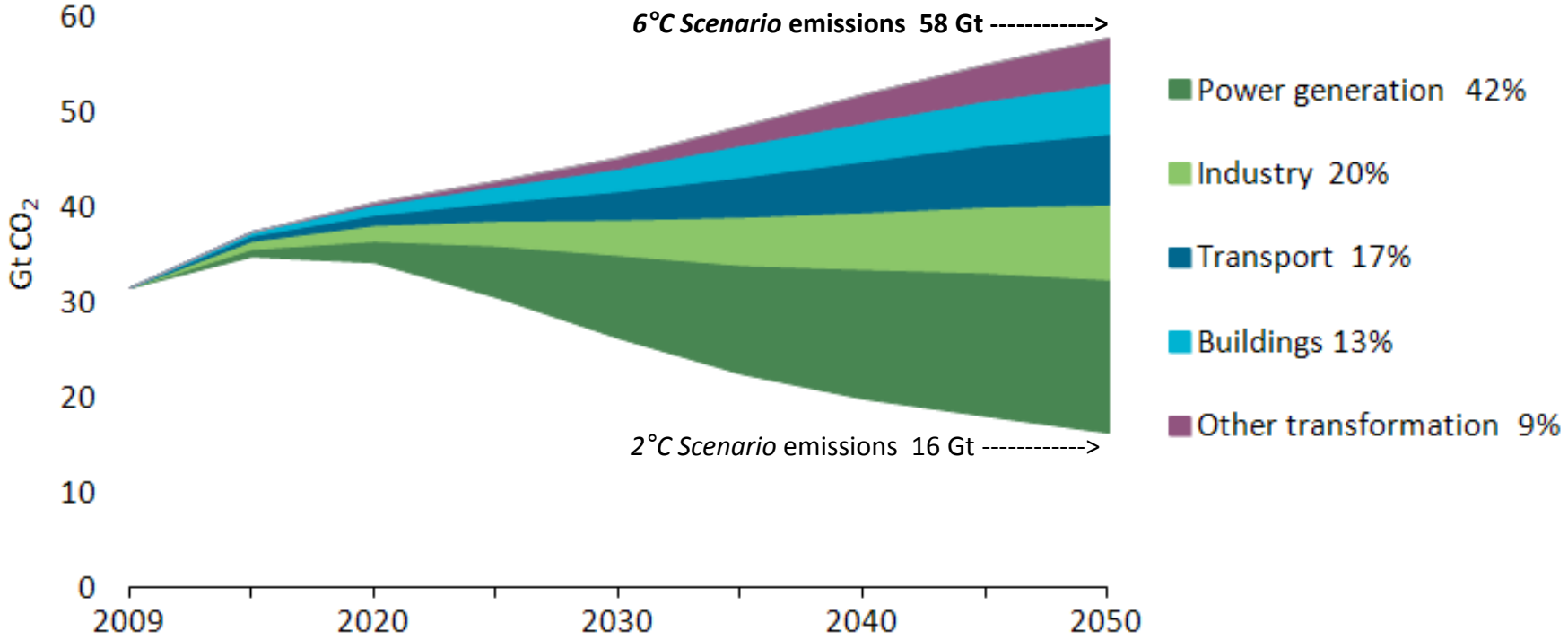


Introduction to Energy Technology Roadmaps

Energy technology roadmaps

International Energy Agency

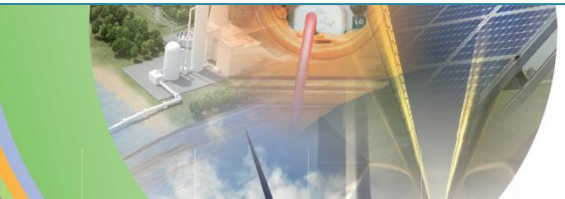
Key technologies for reducing global CO_2 emissions



Source: Energy Technology Perspectives 2012

- **6°C Scenario – business-as-usual; no adoption of new energy and climate policies**
- **2°C Scenario - energy-related CO_2-emissions halved by 2050 through CO_2-price and strong policies**

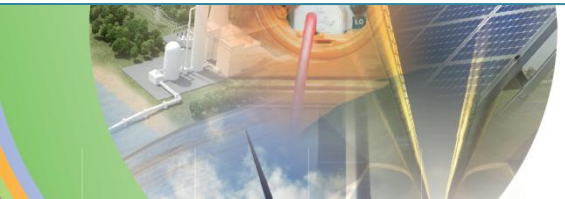
ABOUT TECHNOLOGY ROADMAPS



IEA Roadmap Definition

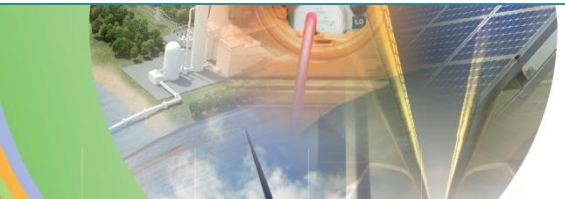
"A technology roadmap is a dynamic set of technical, policy, legal, financial, market & organizational requirements identified by all stakeholders involved in its development. The effort shall lead to improved and enhanced sharing and collaboration of all related technology-specific RDD&D information among participants.

The goal is to accelerate the overall RDD&D process in order to deliver an earlier uptake of the specific energy technology into the marketplace".



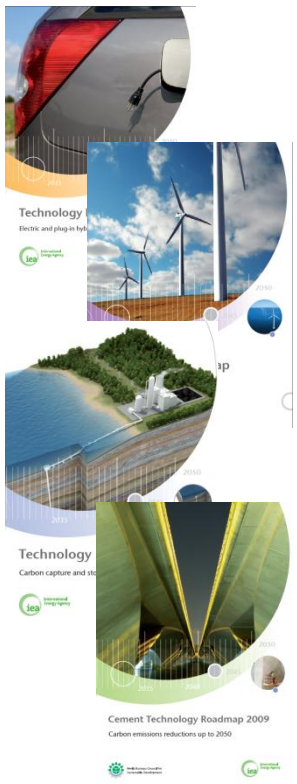
Technology roadmaps provide answers

- **Where is technology today?**
  - GW installed capacity/kWh of savings
  - Leading countries/regions
  - Cost, efficiency
- **What is the deployment pathway needed to achieve 2050 goals?**
  - Use IEA Energy Technology Perspectives BLUE Map scenarios
- **What are the priority near-term actions?**
  - R&D gaps and how to fill them
  - Identify barriers and obstacles and how to overcome
  - Market requirements and policy needs
  - Technology diffusion/transfer and international collaboration needs

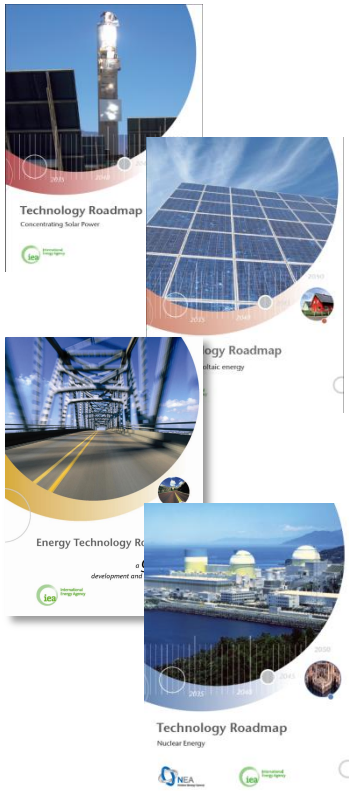


Technology roadmaps status

2009



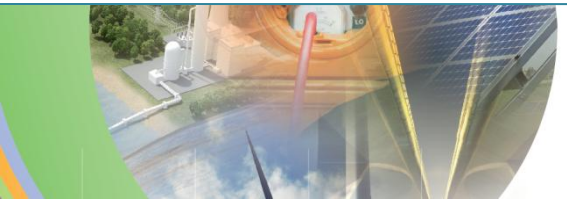
2010



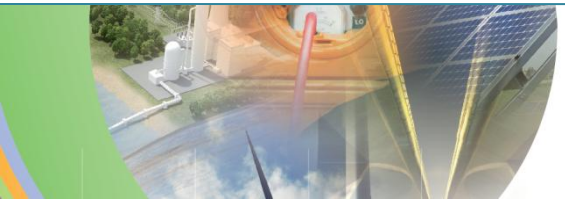
2011

2012 / 2013

- **Bioenergy for heat and power**
- **Vehicle Fuel Economy**
- **Solar heating & cooling**
- **High efficiency, low emissions coal**
- **Chemical catalysis**
- **Hydropower**
- **Energy efficient building envelopes**

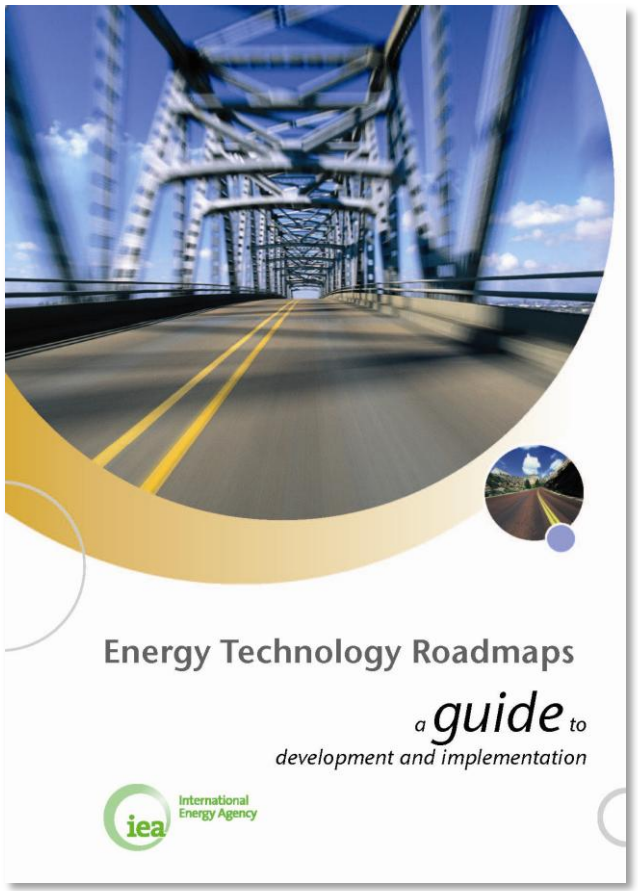


HOW-TO GUIDE



Energy technology roadmaps guide

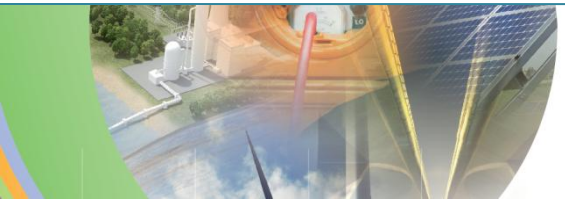
- Guide published in 2010 by IEA
  - Understanding roadmaps
  - Roadmap development process
  - Tailoring the roadmap process



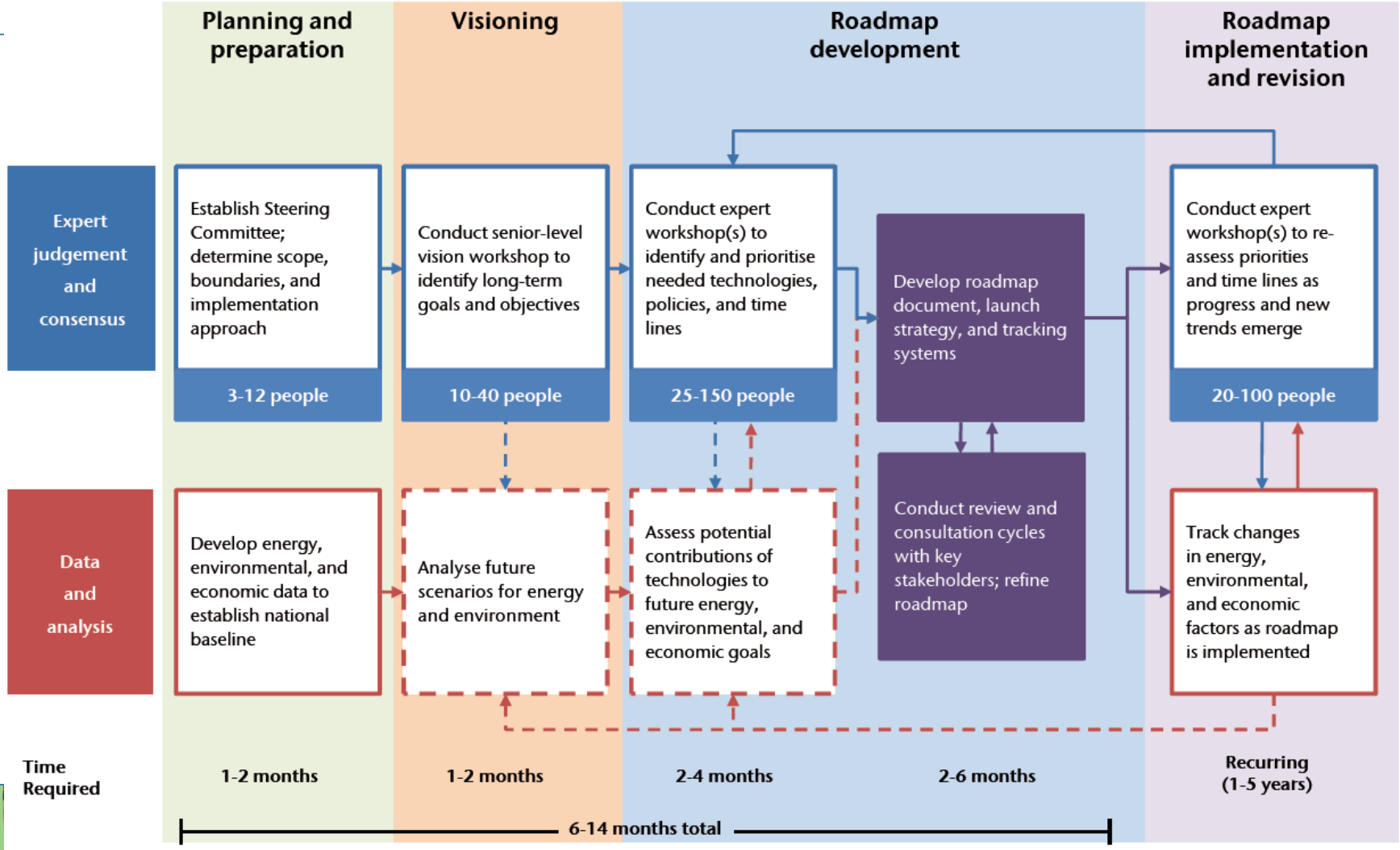
http://www.iea.org/publications/free_new_Desc.asp?PUBS_ID=2291

Roadmap logic

- Goal to achieve
- Milestones to be met
- Gaps to be filled
- Actions to overcome gaps and barriers
- What and when things need to be achieved

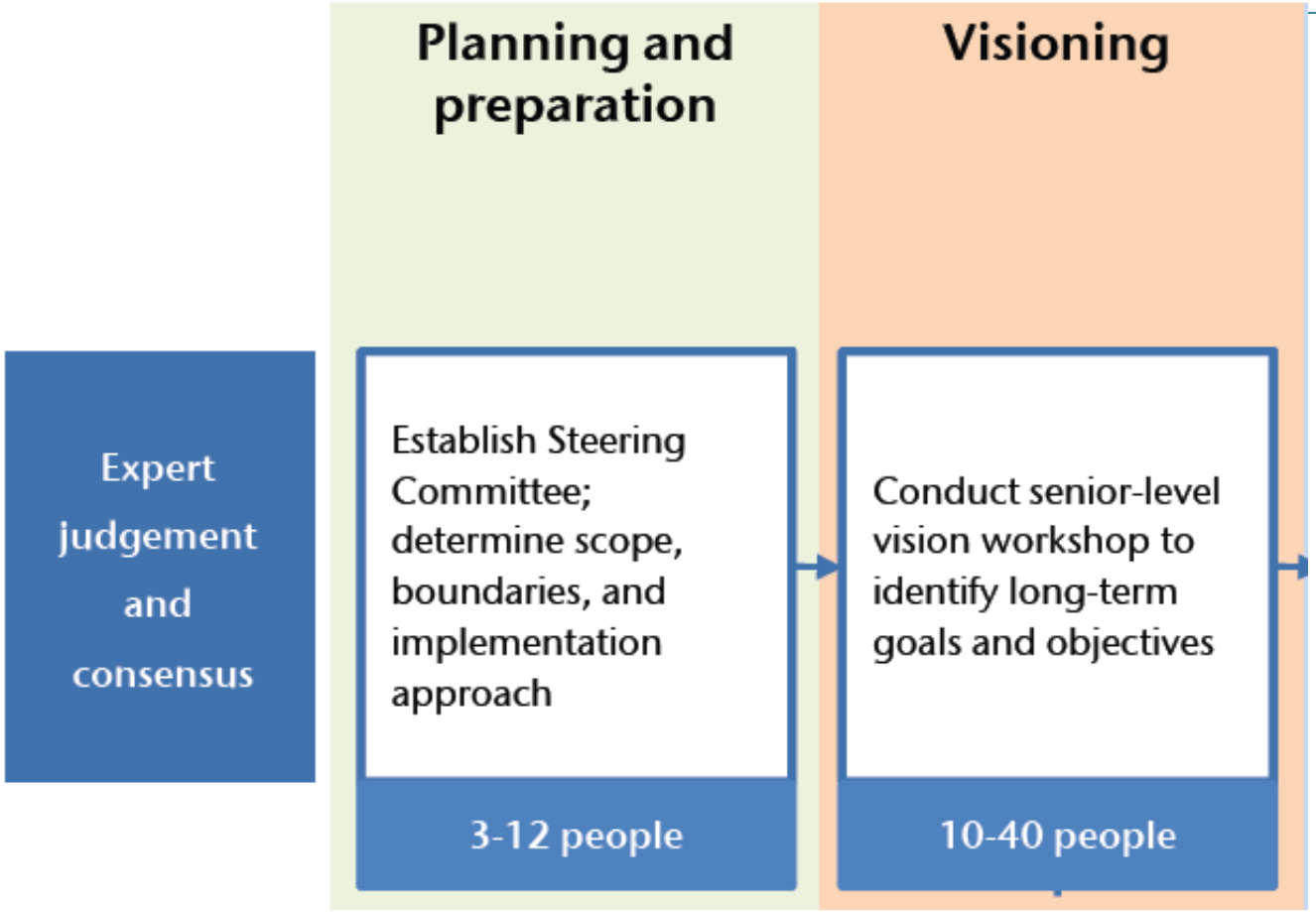


Roadmap process outline

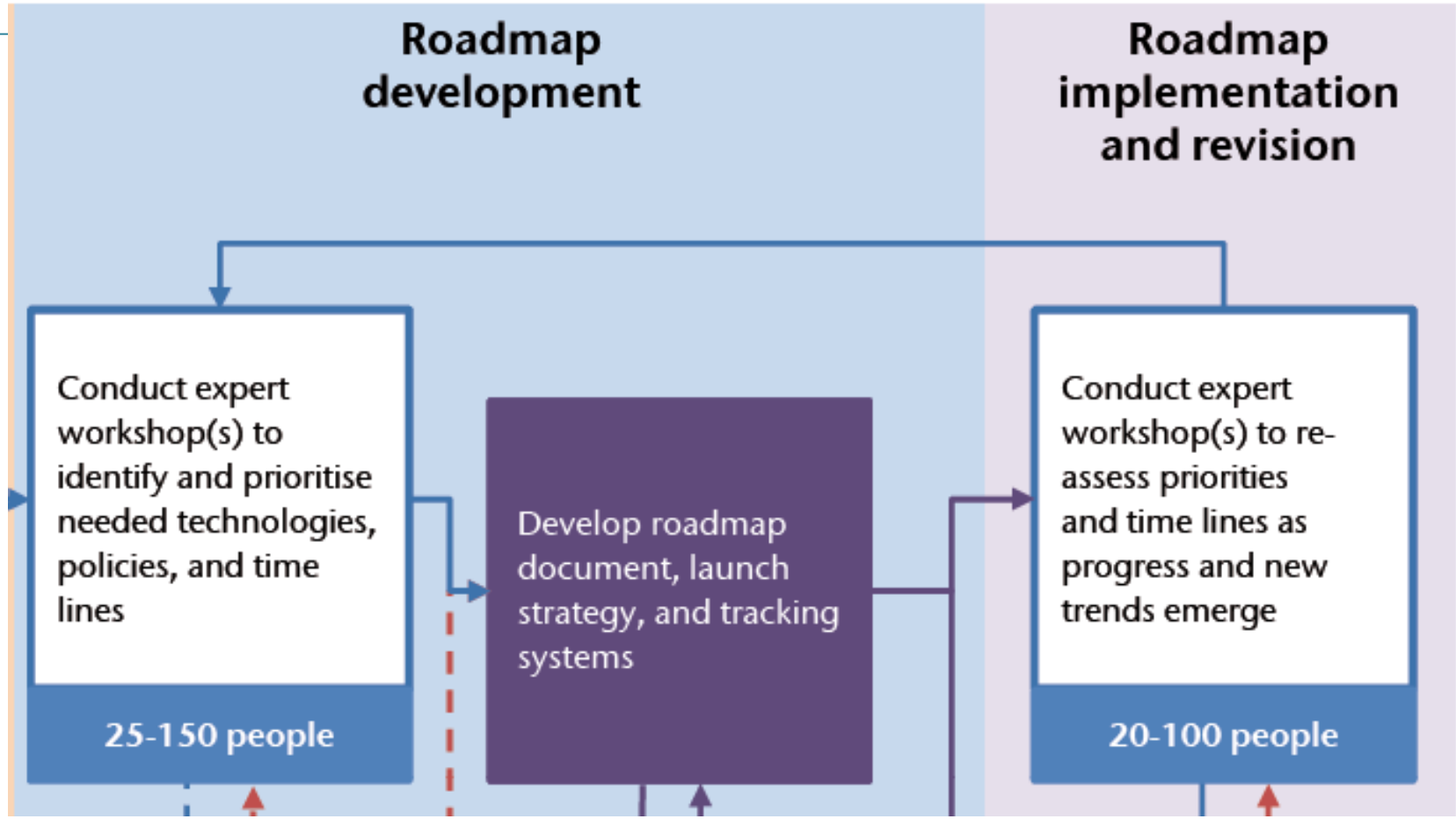


Note: Dotted lines indicate optional steps, based on analysis capabilities and resources.

Roadmap process outline

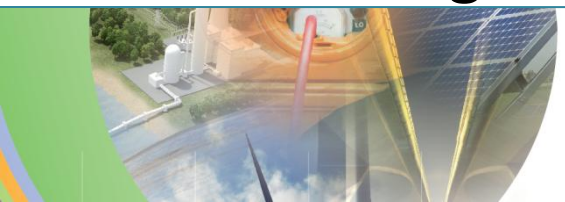


Roadmap process outline

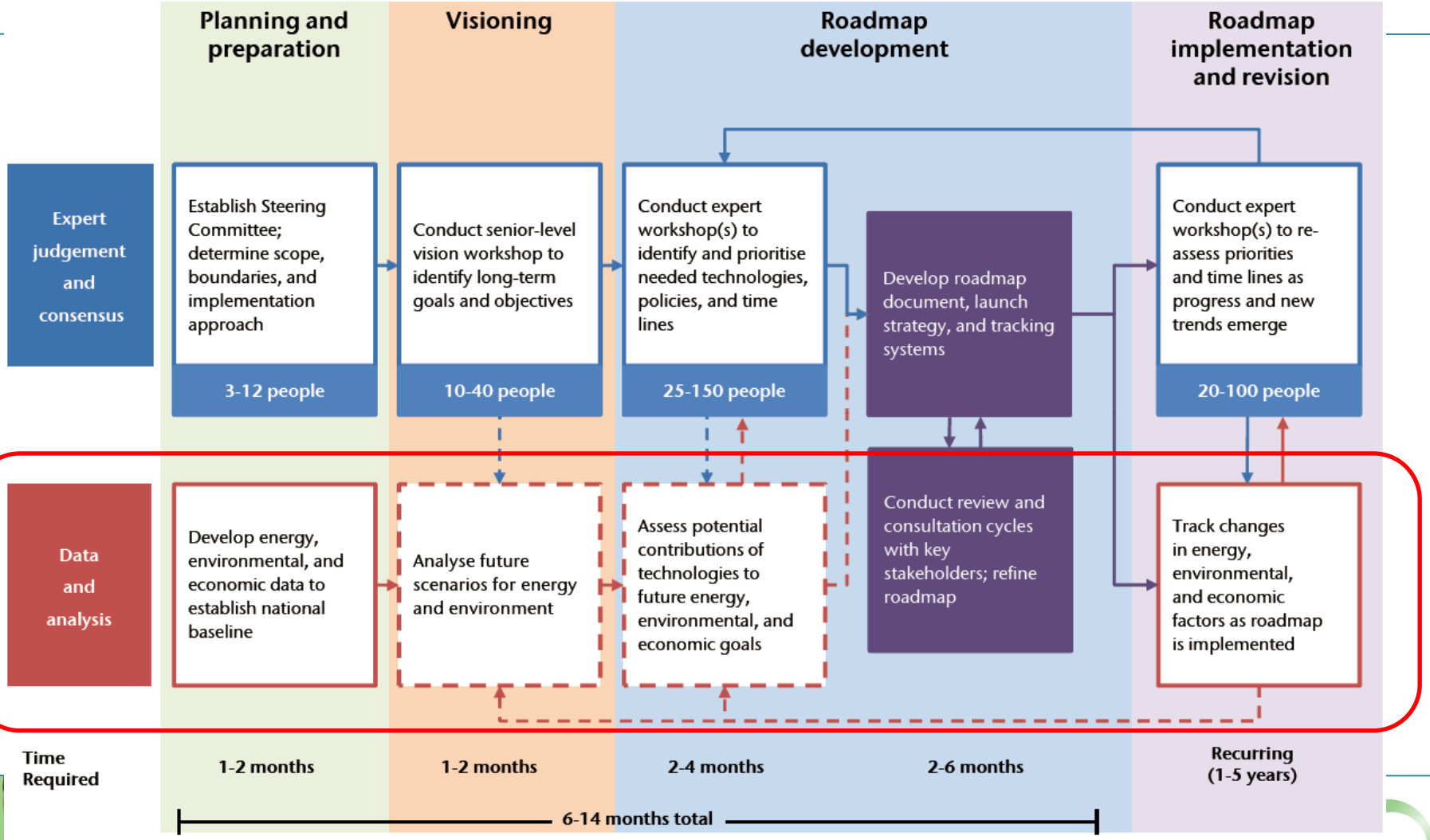


Expert judgment and consensus: roadmap workshops

- Structured vision and technology roadmap workshops can:
  - Build consensus on goals and targets
  - Evaluate and verify assumptions
  - Identify technical and institutional barriers
  - Define alternative technology pathways
  - Develop implementation strategies and priorities



Roadmap process outline

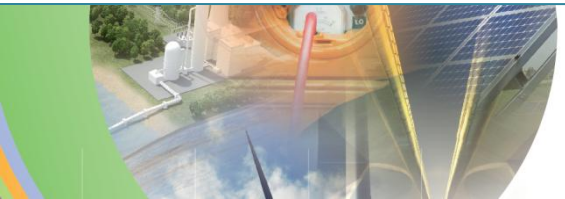


Note: Dotted lines indicate optional steps, based on analysis capabilities and resources.

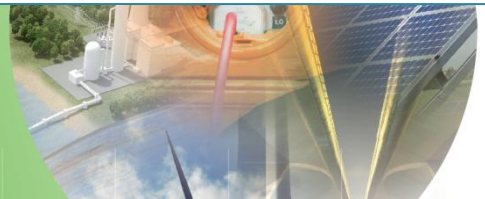
Baseline data

Situation analysis of key factors:

- Technologies:
  - Current status of costs and performance
  - Technology readiness
  - Market penetration and limitations
- Markets:
  - Suppliers, distributors and customers
  - Energy characteristics (production, delivery, storage and consumption)
  - Environmental impacts (air, water and land impacts)
- Public policies:
  - Current status and requirements of relevant, existing laws and regulations

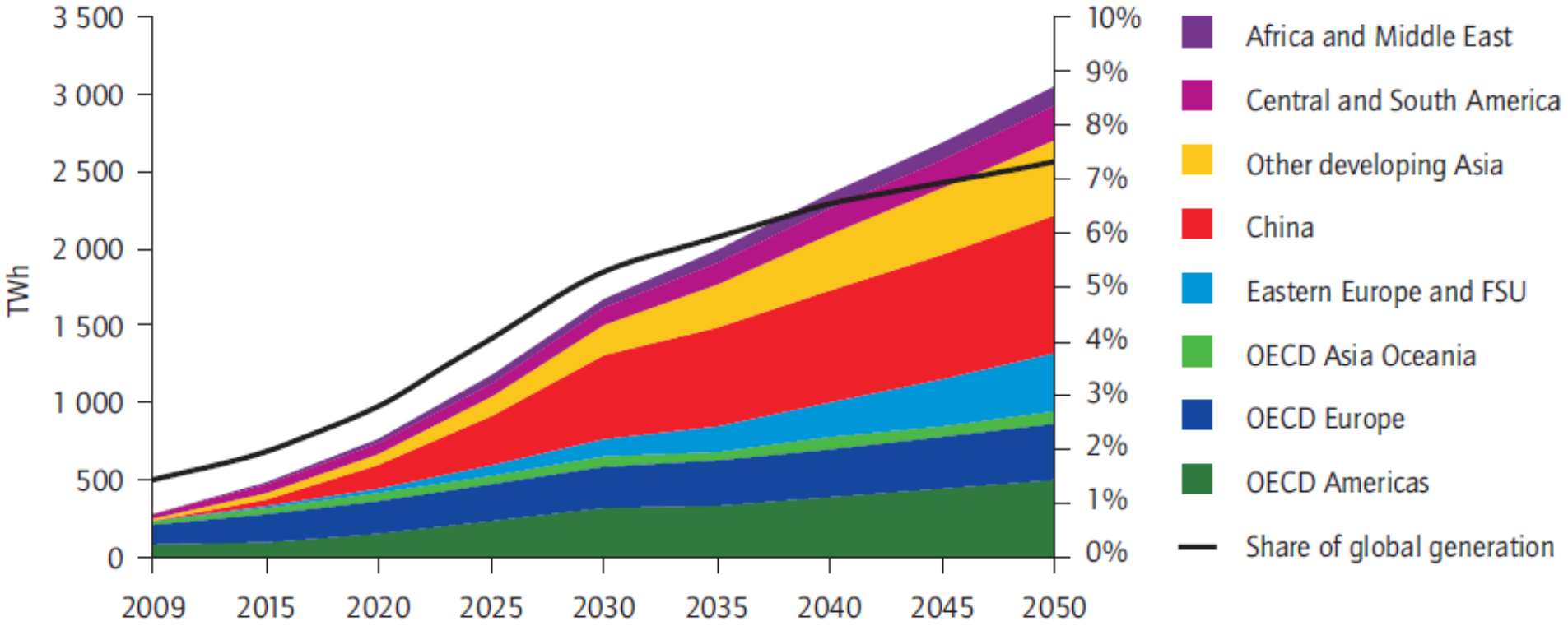


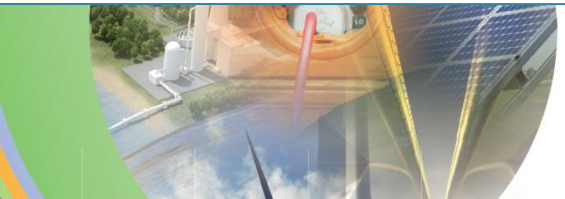
IEA ROADMAP EXAMPLES



Bioenergy roadmap

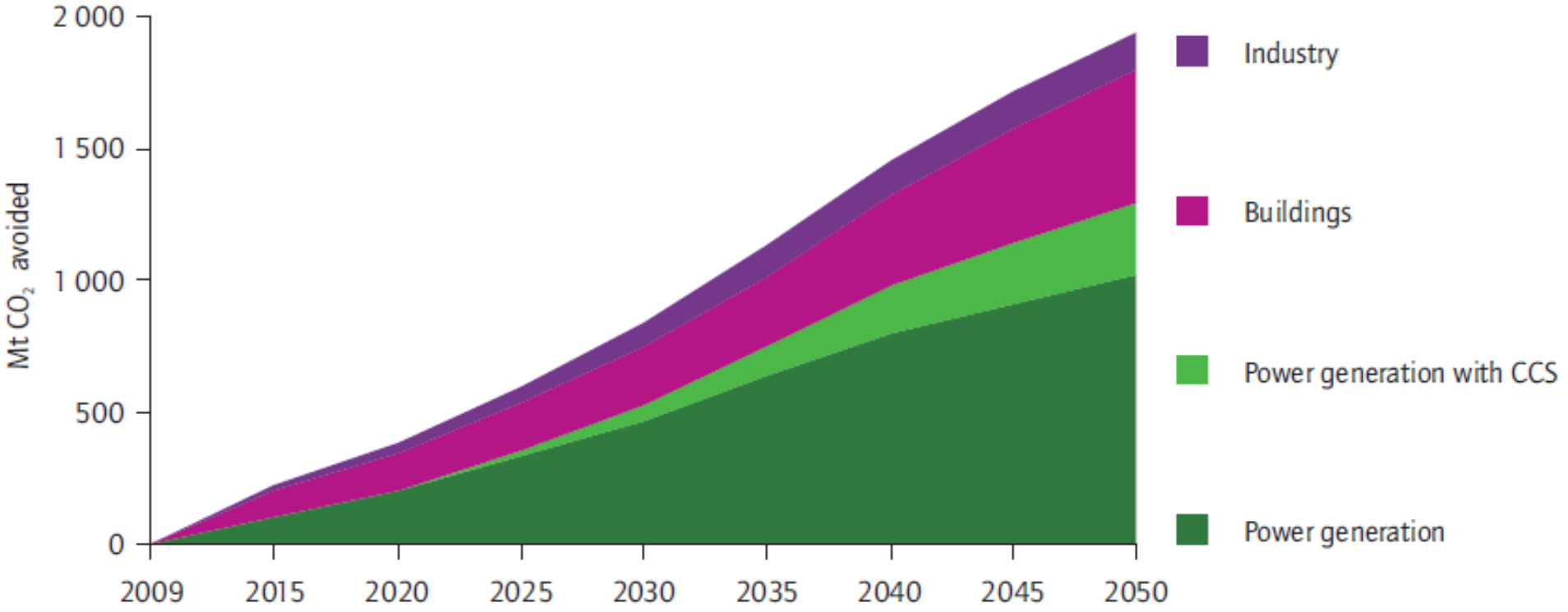
World bioenergy electricity supply to grow more then ten-fold





Bioenergy roadmap

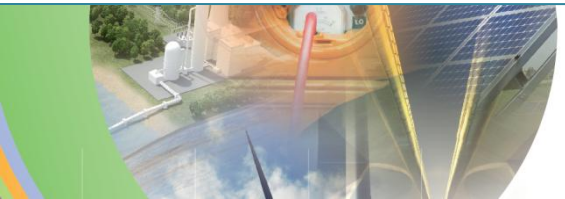
2 Gt $CO_{2\text{-eq}}$ emission reductions through bioenergy heat and power



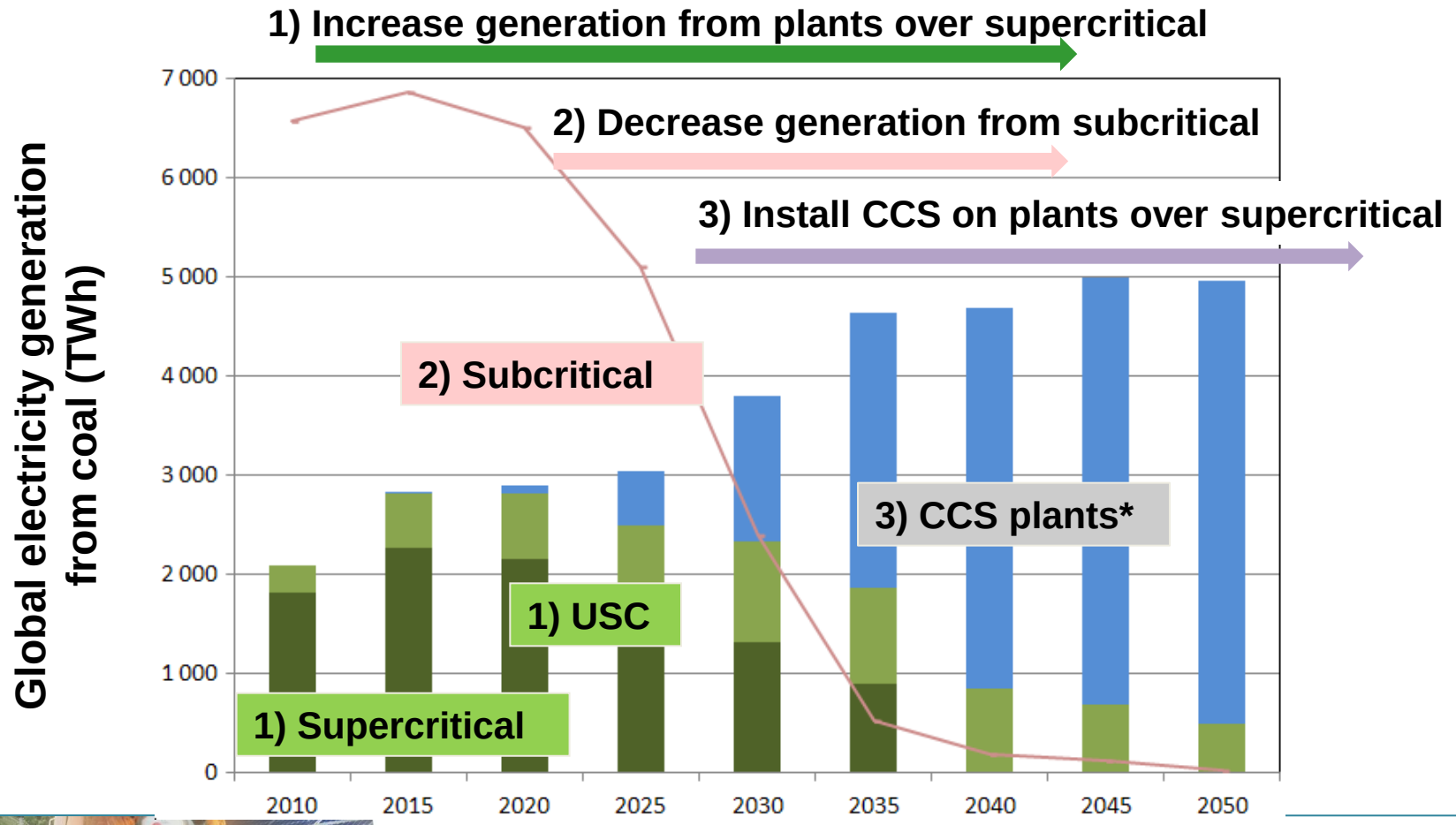
Note: This assumes that biomass is sourced sustainably with very low life-cycle GHG emissions.

EV/PHEV roadmap example: milestones

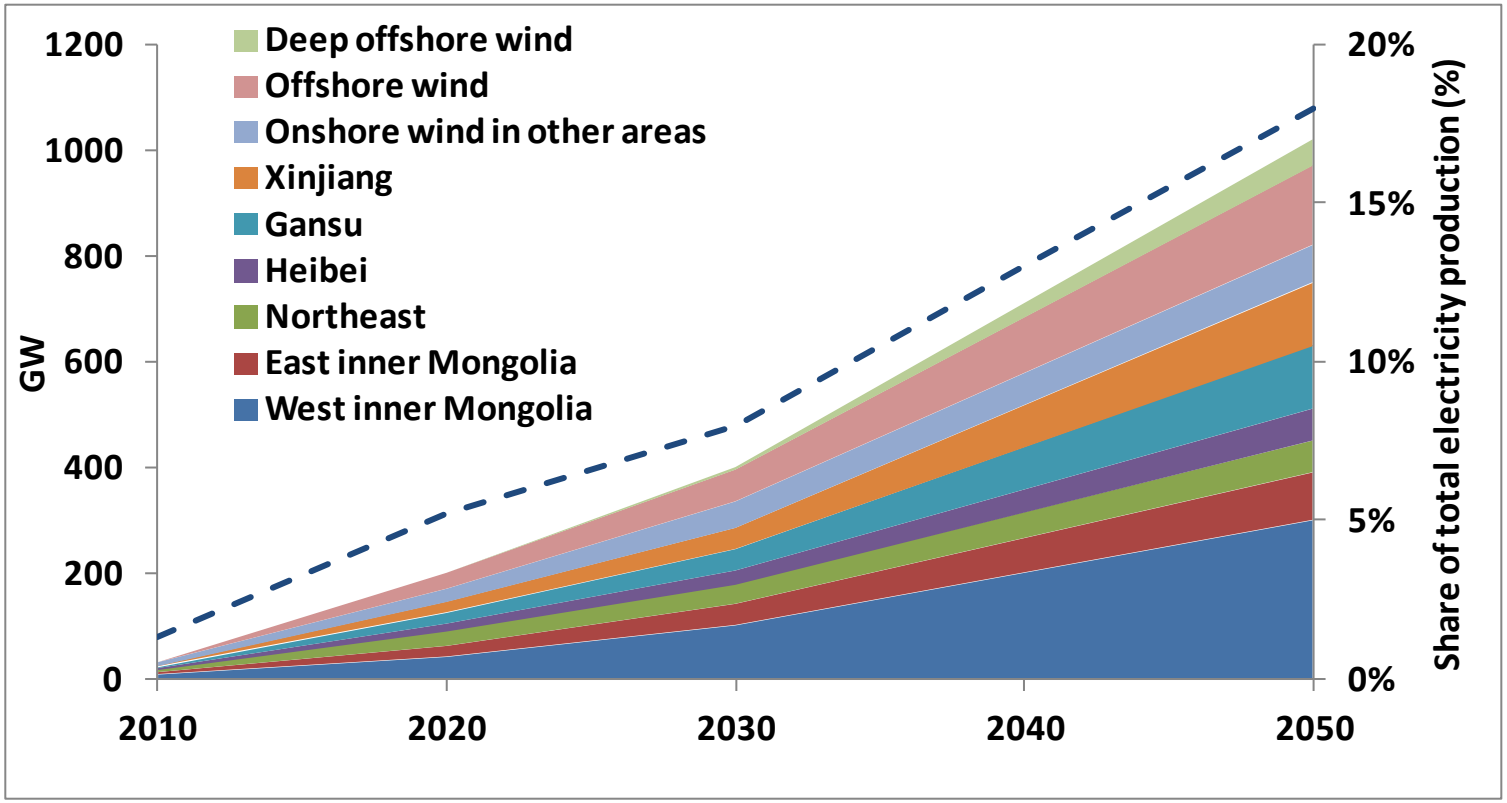
Milestones:	2010-2012	2012-2015	2015-2020
Policy framework	Develop policy frameworks focused on early adopters with incentives for consumers / manufacturers		Review of policies and updates to reflect best practices; support for expansion of infrastructure and to ensure EV/PHEV sales are on track
Vehicles / batteries	Begin production of EV and PHEV models, low-production volume demonstrations to test batteries and controls, and assist design optimizations		Rapidly increase numbers of models offered and average production volumes; battery and other costs begin to decline
Codes / standards	Create common standards for plugs and recharging protocols in each major region		Ensure that smart metering is available for home recharging with dual tariffs in early adopter areas
Recharging / electricity infrastructure	Focus on areas likely to require recharging infrastructure through 2015; target early adopter homes and public locations		Begin major investments in increased street/office daytime commercial recharging, including rapid charging where possible
RD&D	Ensure early vehicle/battery models are safe; achieve near-term technical targets; continue RD&D on advanced battery designs		Progress toward battery cost targets of USD 300/ kWh; incorporate lessons learned from early experiences

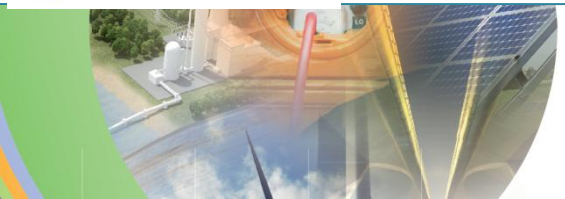


High efficiency low emissions coal roadmap



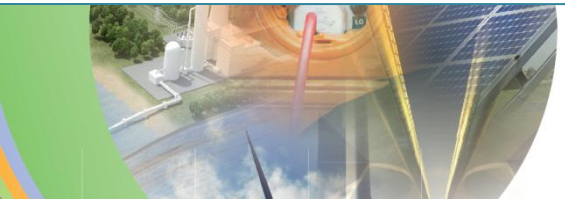
China wind roadmap





A final thought

- Roadmaps can be powerful tools for
  - Aligning interests and skills of diverse stakeholders
  - Identifying steps and timing needed to achieve a chosen future
  - Generating buy-in and support that leads to real action
  - Monitoring progress against stated milestones and adjusting the plan as needed



For more information

- Download the guide:

  http://www.iea.org/papers/roadmaps/guide.pdf

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  cecilia.tam@iea.org