Introduction to Energy Technology Roadmaps
Key technologies for reducing global CO₂ emissions

- **6°C Scenario** emissions: 58 Gt
- **2°C Scenario** emissions: 16 Gt

Source: Energy Technology Perspectives 2012

- **6°C Scenario** – business-as-usual; no adoption of new energy and climate policies
- **2°C Scenario** - energy-related CO₂-emissions halved by 2050 through CO₂-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”.

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

- **2010**

- **2011**

- **2012 / 2013**
  - Bioenergy for heat and power
  - Vehicle Fuel Economy
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Energy technology roadmaps

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HOW-TO GUIDE
Energy technology roadmaps guide

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

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

Planning and preparation
- Expert judgement and consensus
  - Establish Steering Committee; determine scope, boundaries, and implementation approach
  - 3-12 people

Visioning
- Analyse future scenarios for energy and environment
  - 1-2 months

Roadmap development
- Conduct expert workshop(s) to identify and prioritise needed technologies, policies, and timelines
  - 25-150 people
- Assess potential contributions of technologies to future energy, environmental, and economic goals
  - 2-4 months
- Develop roadmap document, launch strategy, and tracking systems
  - 2-6 months
- Conduct review and consultation cycles with key stakeholders; refine roadmap

Roadmap implementation and revision
- Conduct expert workshop(s) to reassess priorities and timelines as progress and new trends emerge
  - Recurring (1-5 years)
- Track changes in energy, environmental, and economic factors as roadmap is implemented
  - 20-100 people

Data and analysis
- Develop energy, environmental, and economic data to establish national baseline
  - 1-2 months

Note: Dotted lines indicate optional steps, based on analysis capabilities and resources.
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Expert judgement and consensus
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Energy technology roadmaps
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
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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 than ten-fold

Energy technology roadmaps
Bioenergy roadmap

2 Gt CO$_{2}$-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

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

1) Increase generation from plants over supercritical

2) Decrease generation from subcritical

3) Install CCS on plants over supercritical

Global electricity generation from coal (TWh)

Energy technology roadmaps
China wind roadmap

Energy technology roadmaps
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:
  

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