Energy Technology Perspectives 2015:
Mobilising Innovation to Accelerate Climate Action

Smart Grids in Distribution Networks: Expert workshop in support of deployment and integration in Mexico

Mexico City, 29 May 2015

Jean-François Gagné

Energy Technology Policy Division,

International Energy Agency

International Energy Agency

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IEA Energy Technology Activities

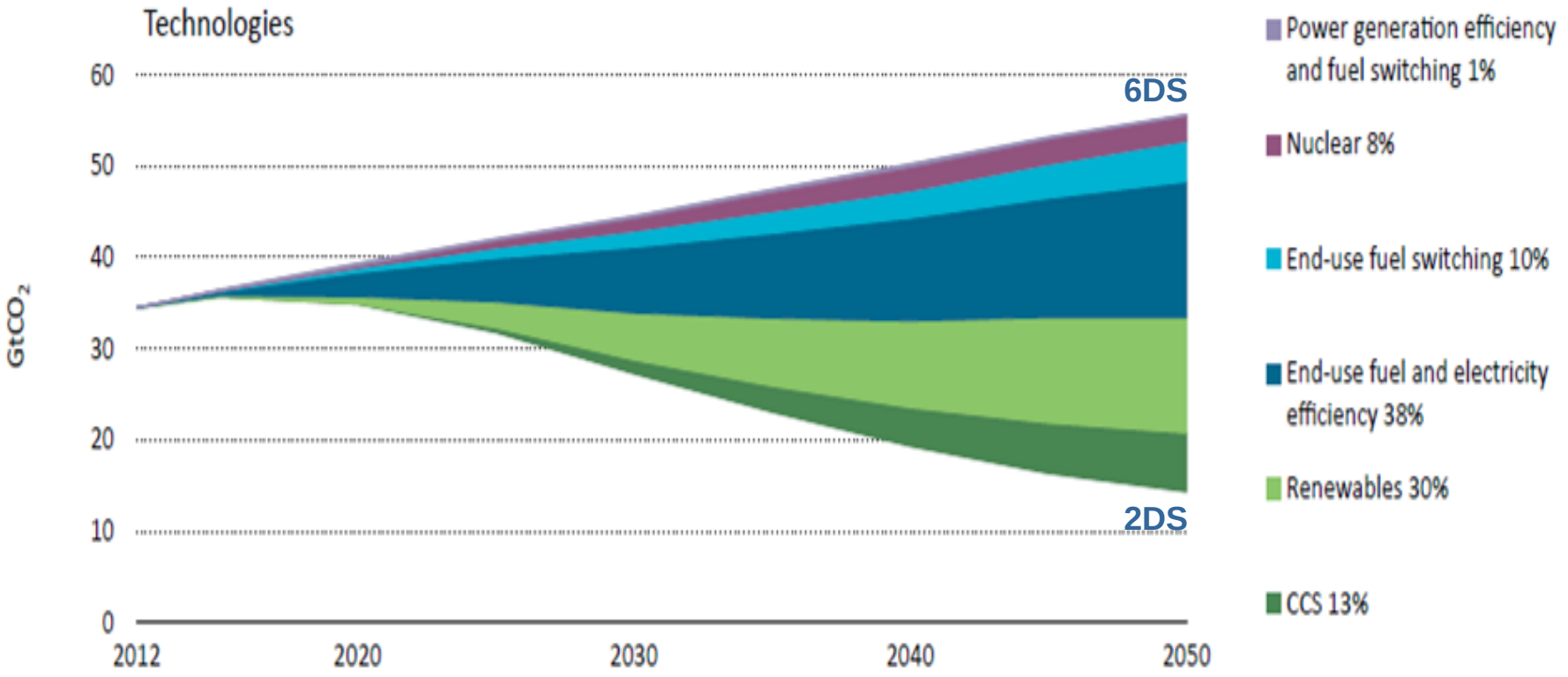
ETP 2015

- Where do we need to go?
- Where are we today?
- How do we get there?

Energy Innovation is crucial in making the 2DS possible

ETP 2015

Contribution of technology area to global cumulative CO2 reductions



Energy innovation has already yielded solutions, but needs support and guidance to deliver on its promises

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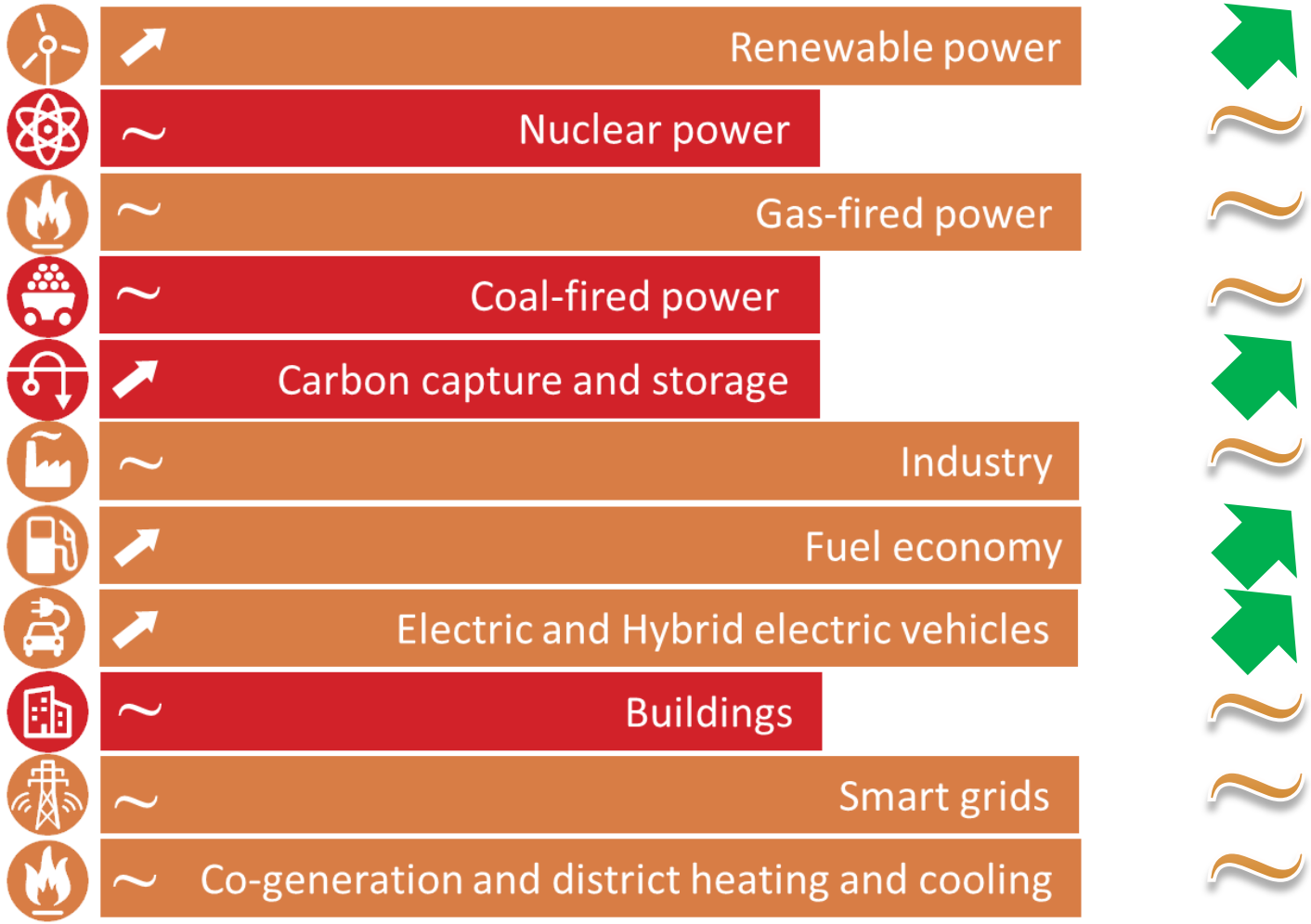
Clean energy is not ramping up fast enough - Despite some progress

ETP 2015



Evidence shows that despite continued progress in many areas, for the first time none of the technologies are in line with 2DS goals

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Technology innovation is making renewable energy markets viable

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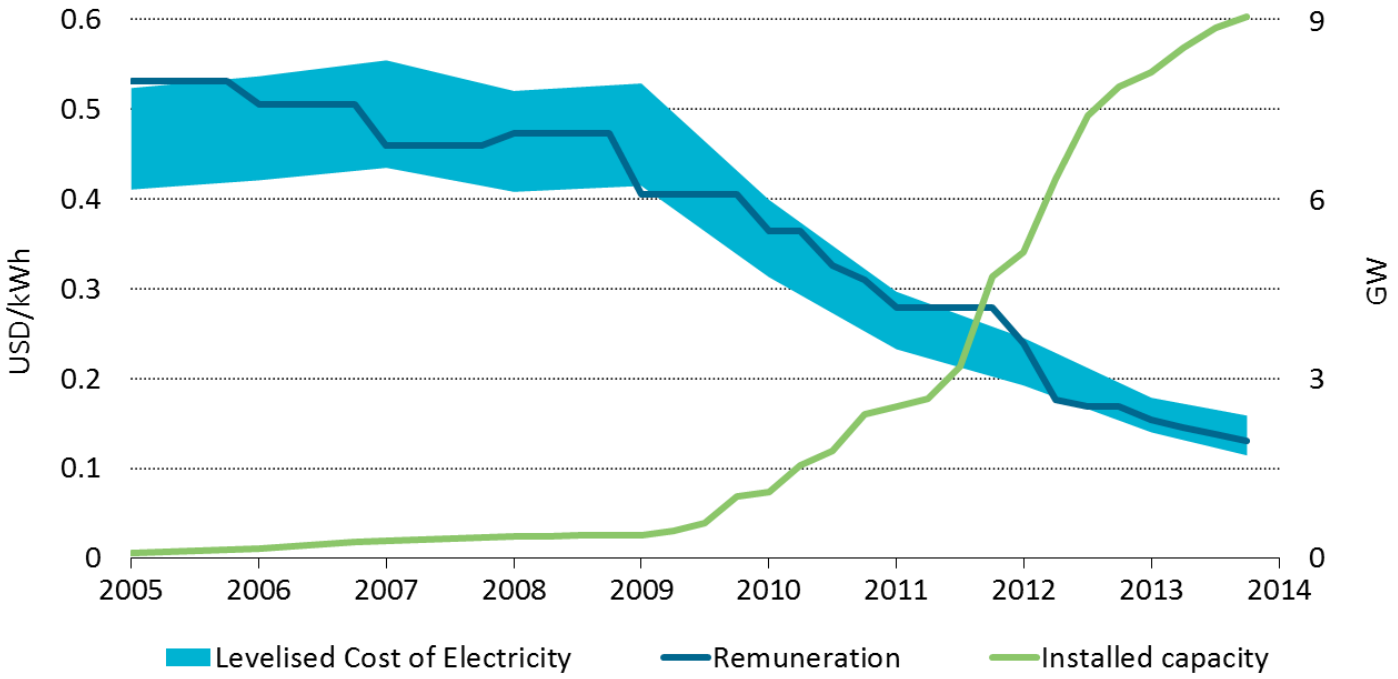
Cost of electricity generated and PV capacity installations in Germany



Thanks to 40 years of innovation efforts, solar PV generation is an increasingly cost competitive option

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Innovation has also helped improve energy efficient technologies

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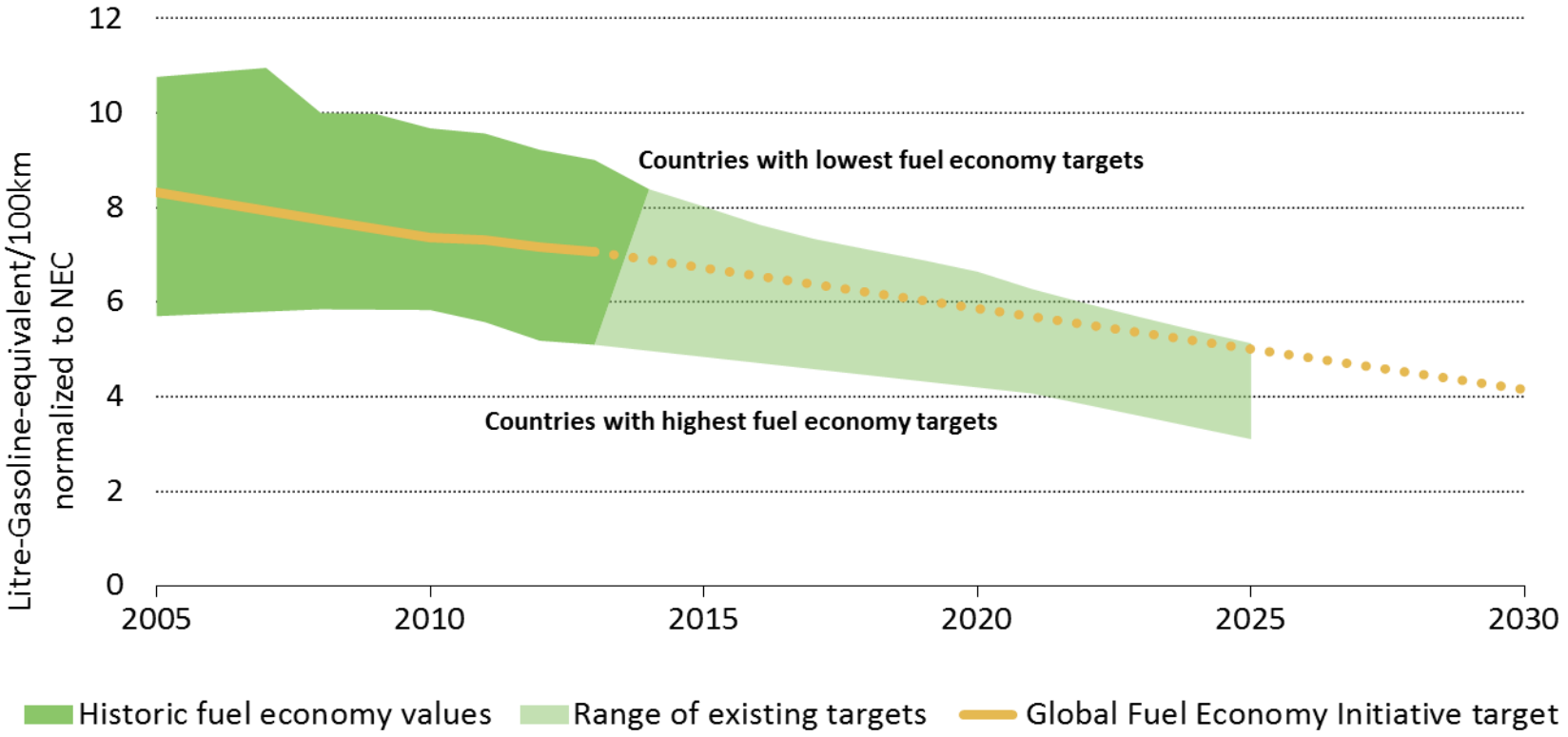
Average new Light-duty vehicle fuel economy evolution by country, 2005 to 2013



Fuel economy is improving as policy increasingly drives the deployment of more efficient vehicle technologies

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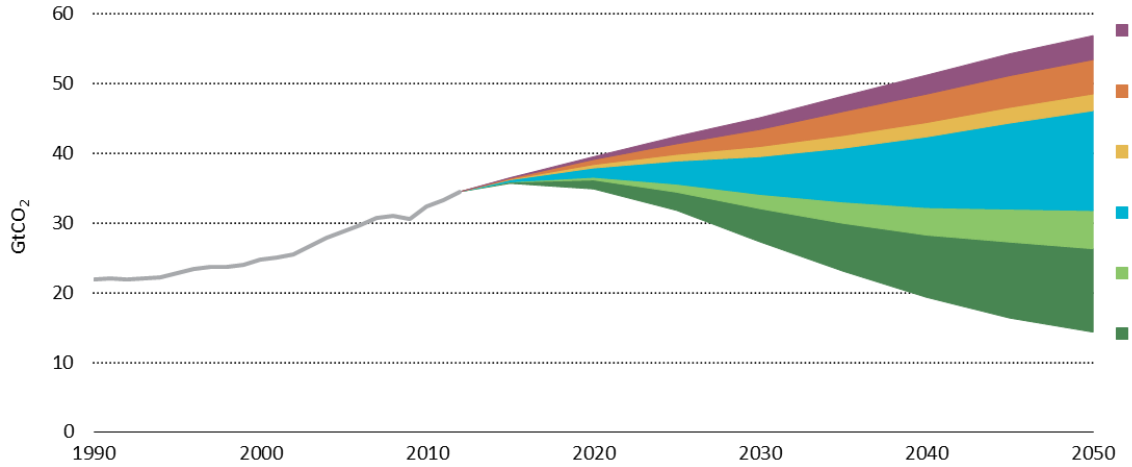
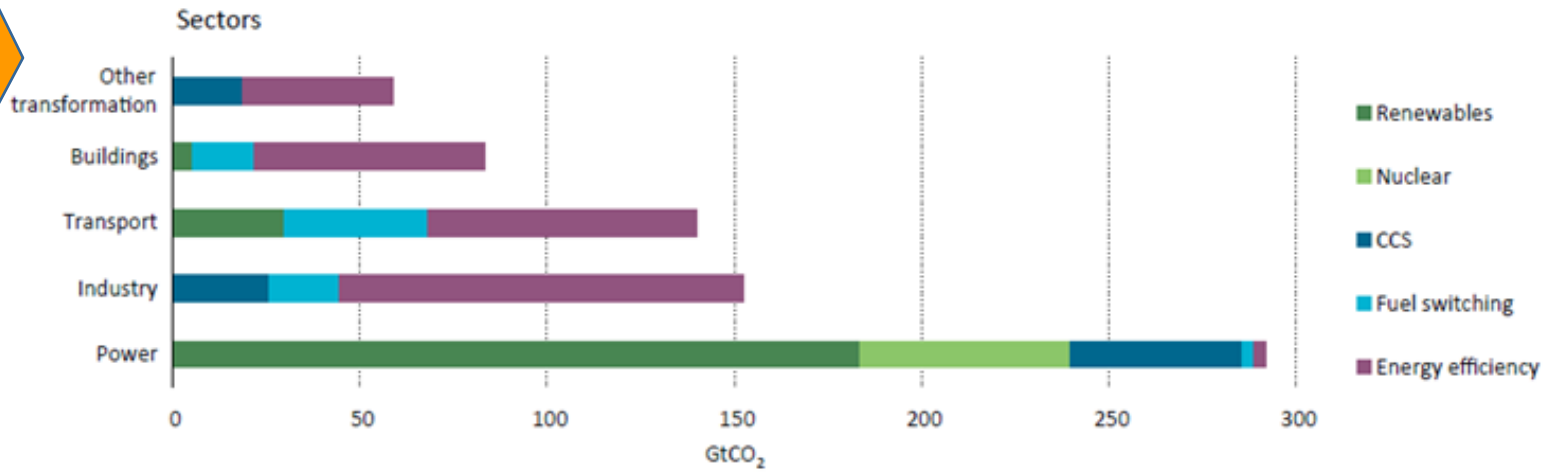
Having the right information can help stimulate support

ETP 2015

From

To





Developing a richer set of data and tracking the right metrics can enhance confidence that efforts pay off

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Energy RD&D funding now targets the right issues, but is not enough

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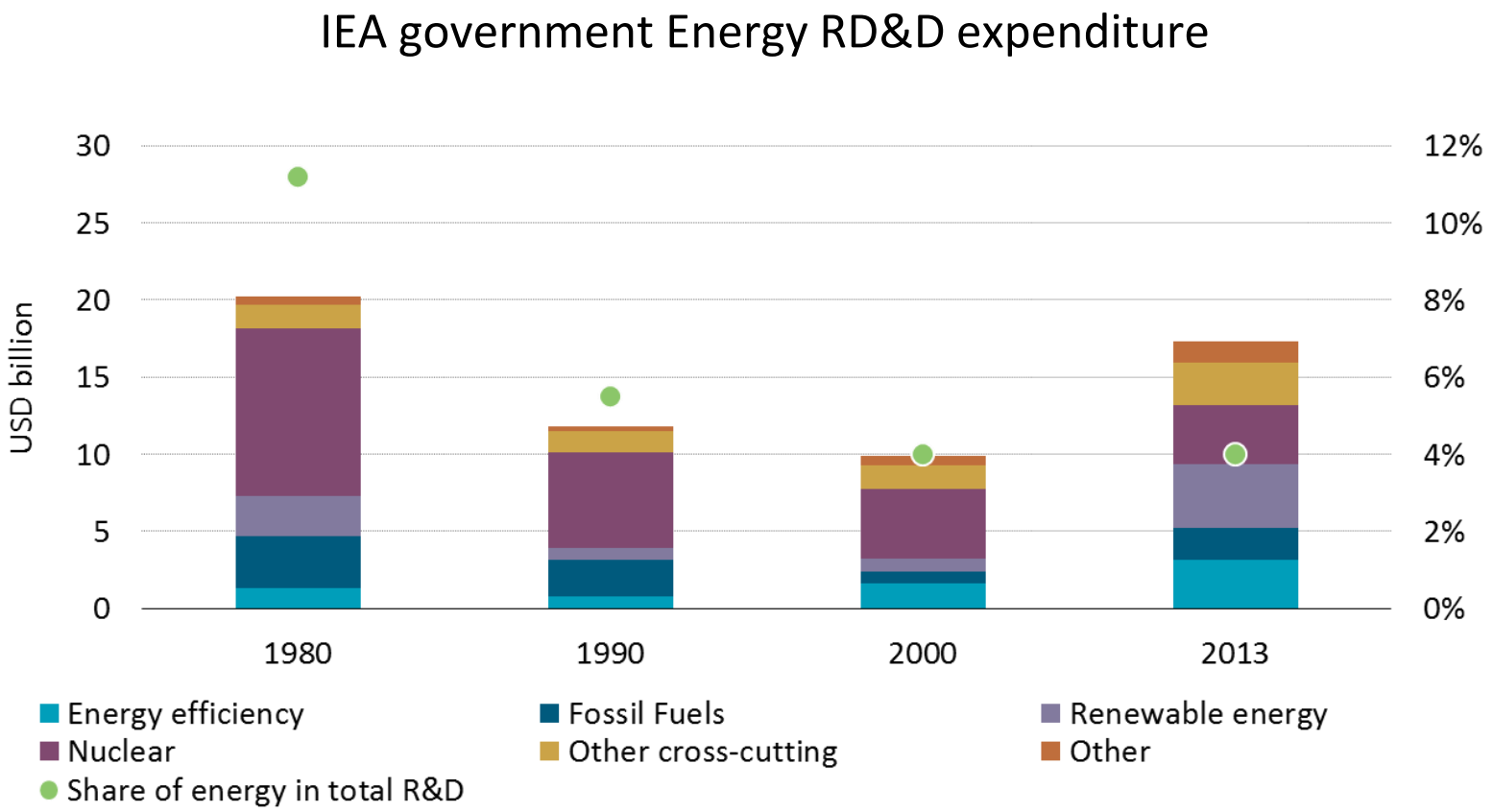

Energy RD&D spending should reflect the importance of energy technology in meeting climate objectives

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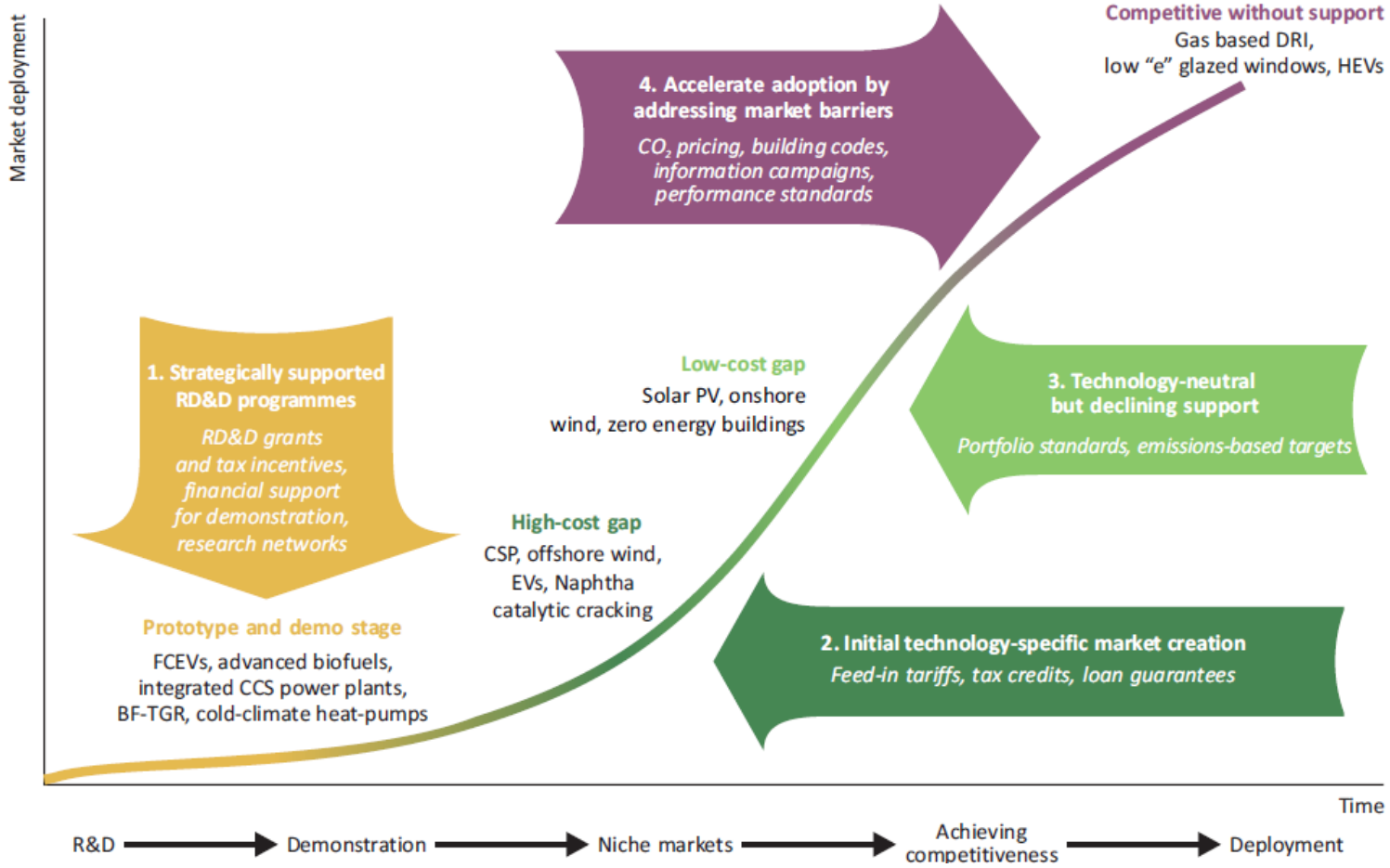
Supporting Energy Innovation: The right policy at the right time

ETP 2015



The right support depends on the maturity of the technology and the degree of market uptake

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Early stage support needs to consider future technology competitiveness

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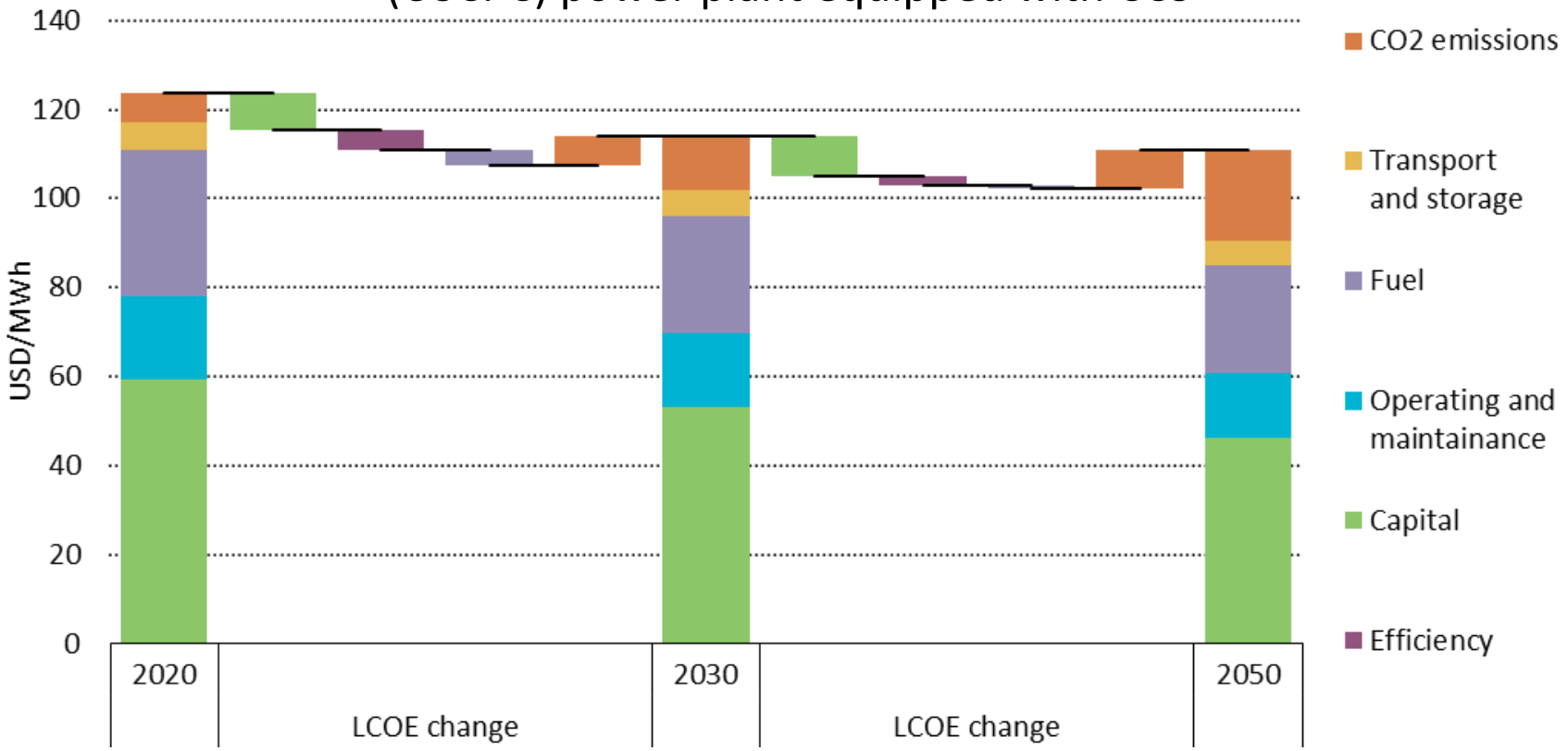
LCOE change in the 2DS of an ultra-supercritical pulverised coal (USCPC) power plant equipped with CCS



Early stage action in CCS technology innovation could help close the cost gap without excessive CO_2 prices

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Deployment at scale needs support addressing market uptake barriers

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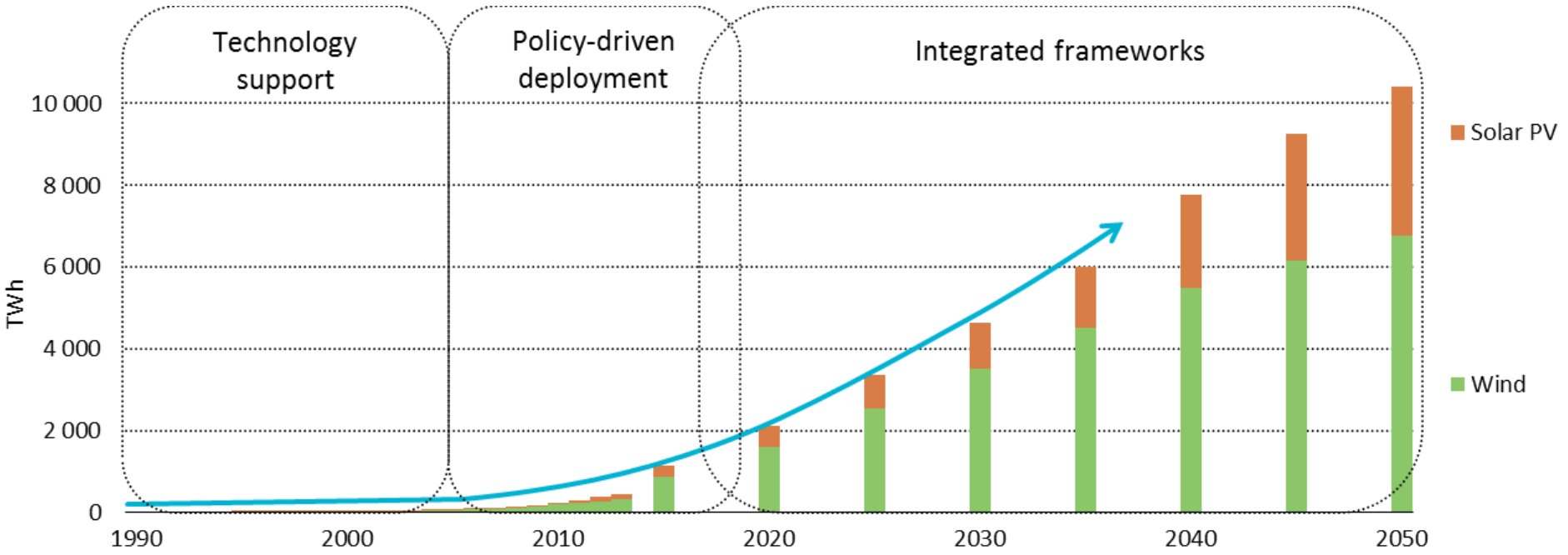
Projections of wind and solar PV generation



Wind and solar PV support needs to move from strictly incentives to integrated and well-designed market, policy and regulatory frameworks

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Innovation is essential for sustainable growth in the industrial sector

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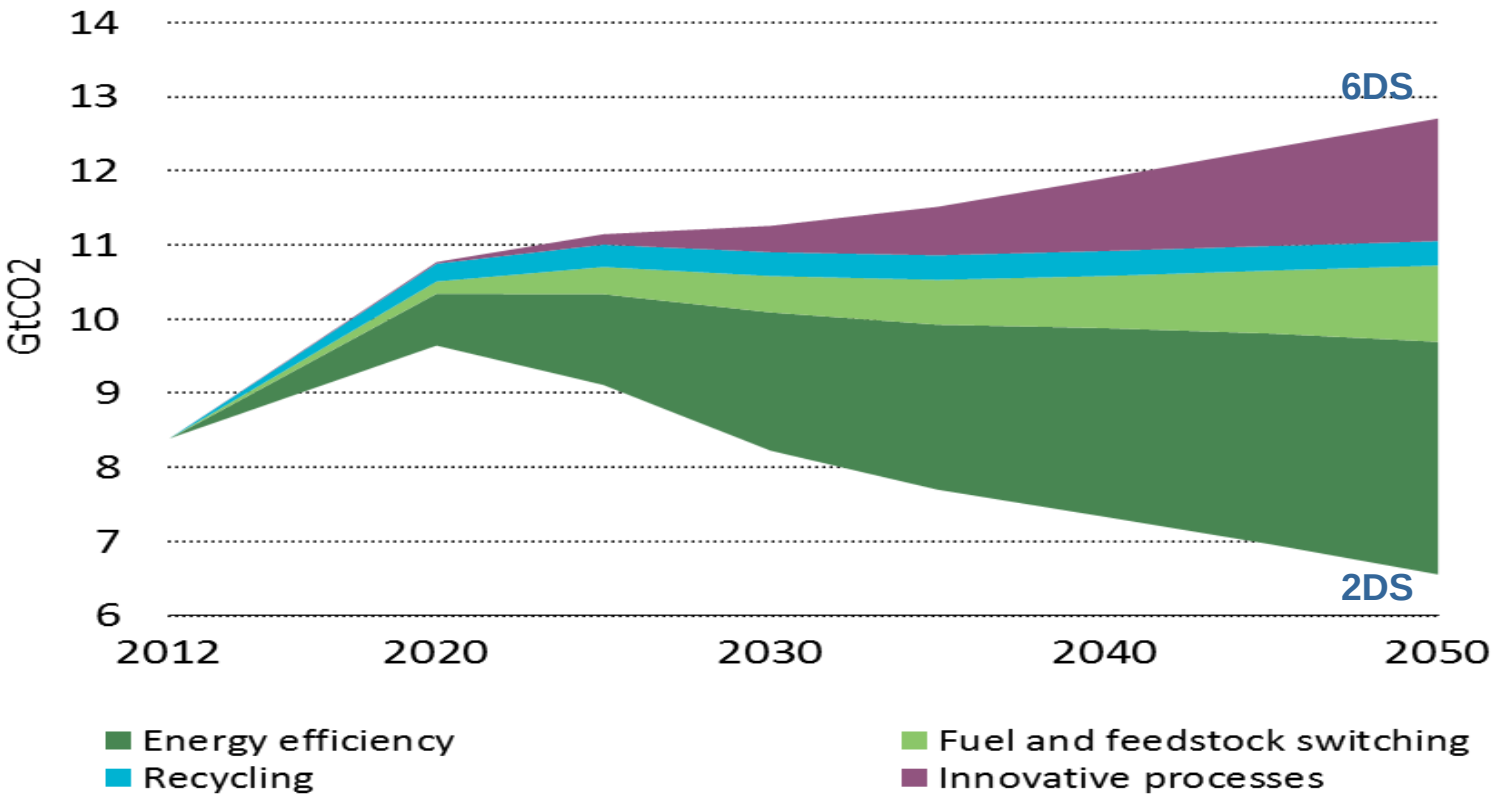
Annual energy-related direct CO2 Emissions in the industrial sector in the 2DS



Public and private entities need to work together to align innovation goals and achieve multiple benefits

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There is no "one-size fits all" solution that can meet all local requirements

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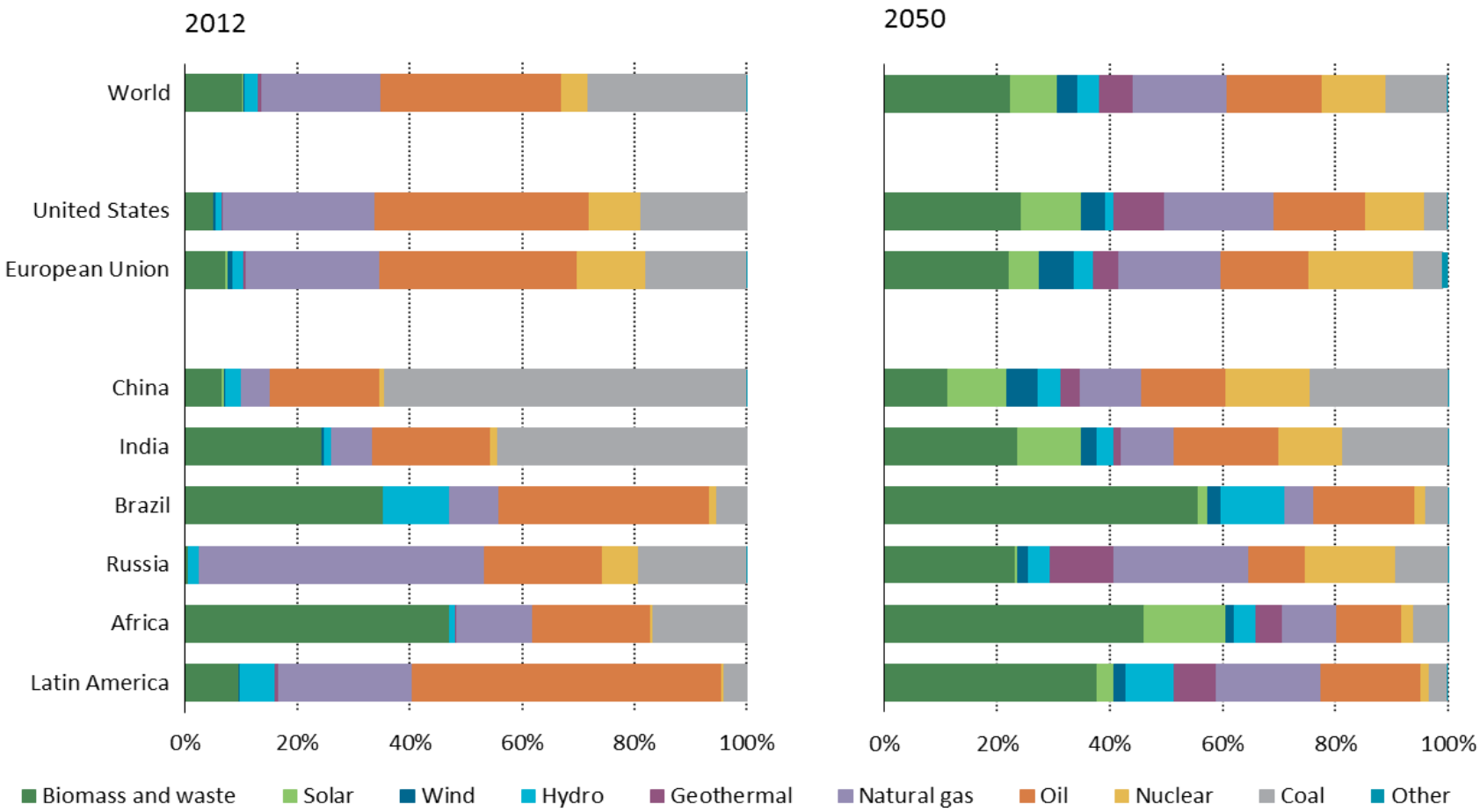
Regional technology shares in primary energy supply



National circumstances and resources will drive different technology portfolios and pathways

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Building innovation capacity is key to successful technology deployment

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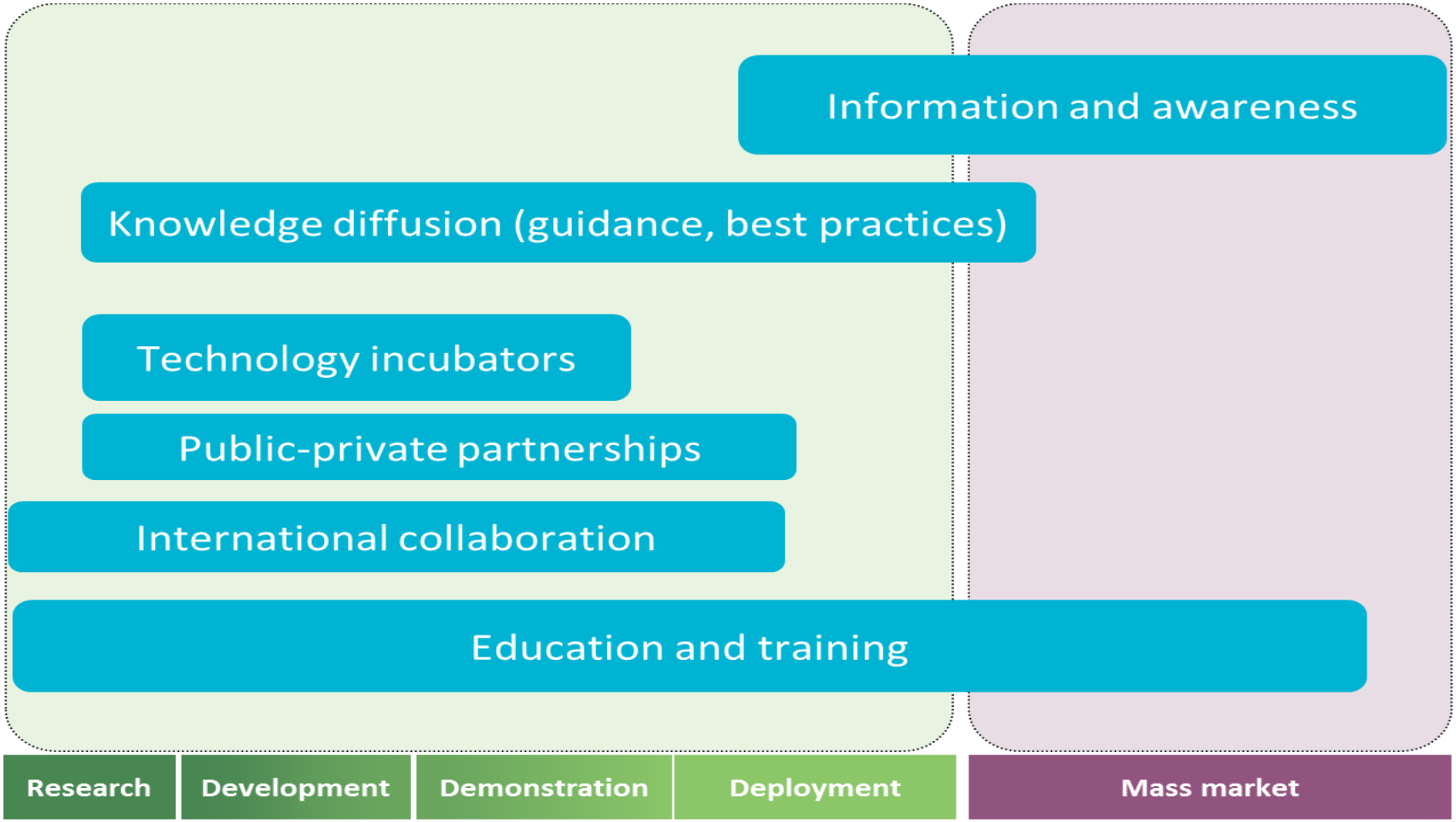

Cooperation between industrial and emerging economies could be a win-win solution

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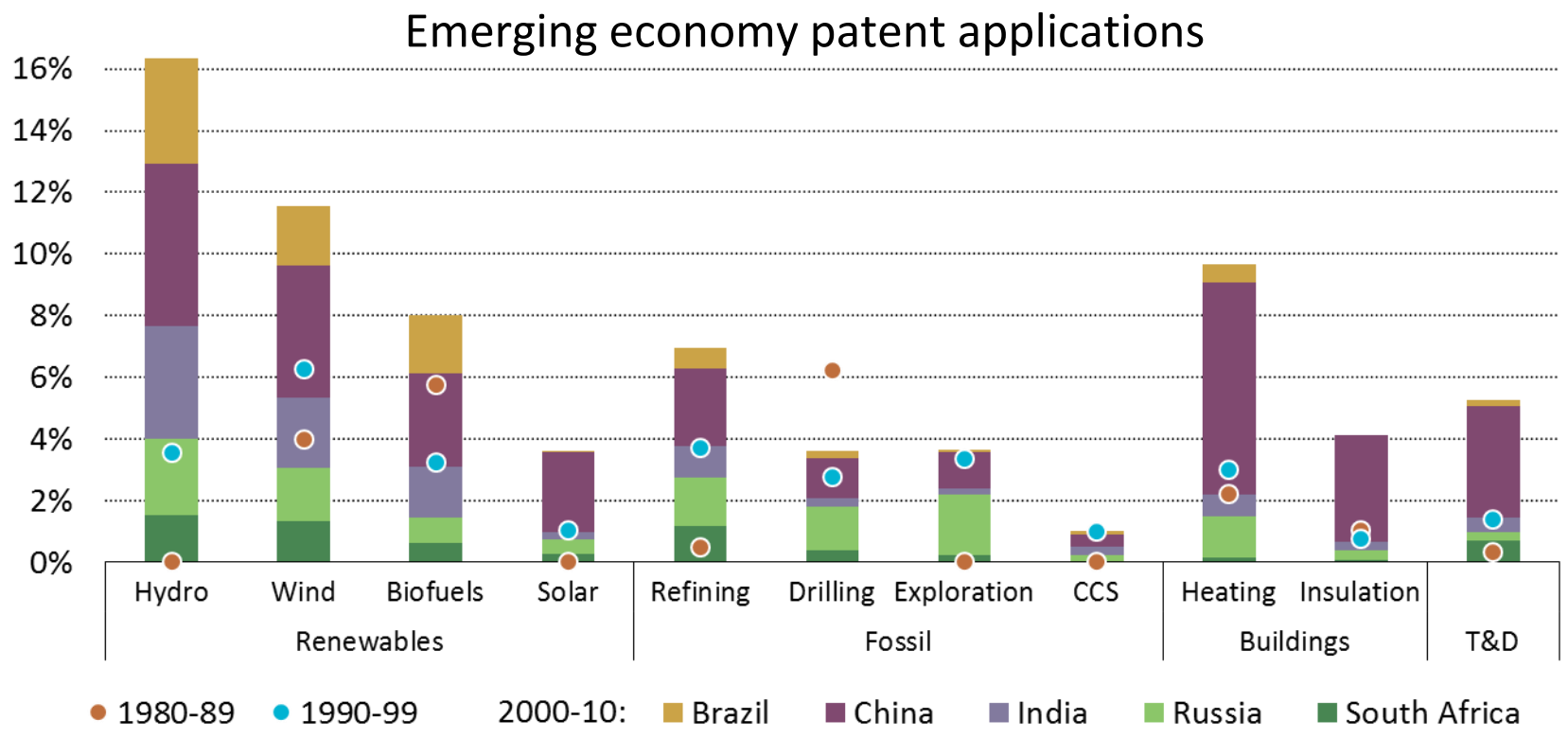
Local innovation capacity is key to successful technology deployment

ETP 2015



Evaluating priorities and opportunities is essential to supporting innovation where it has the most impact

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Solutions exist to China's daunting energy challenge

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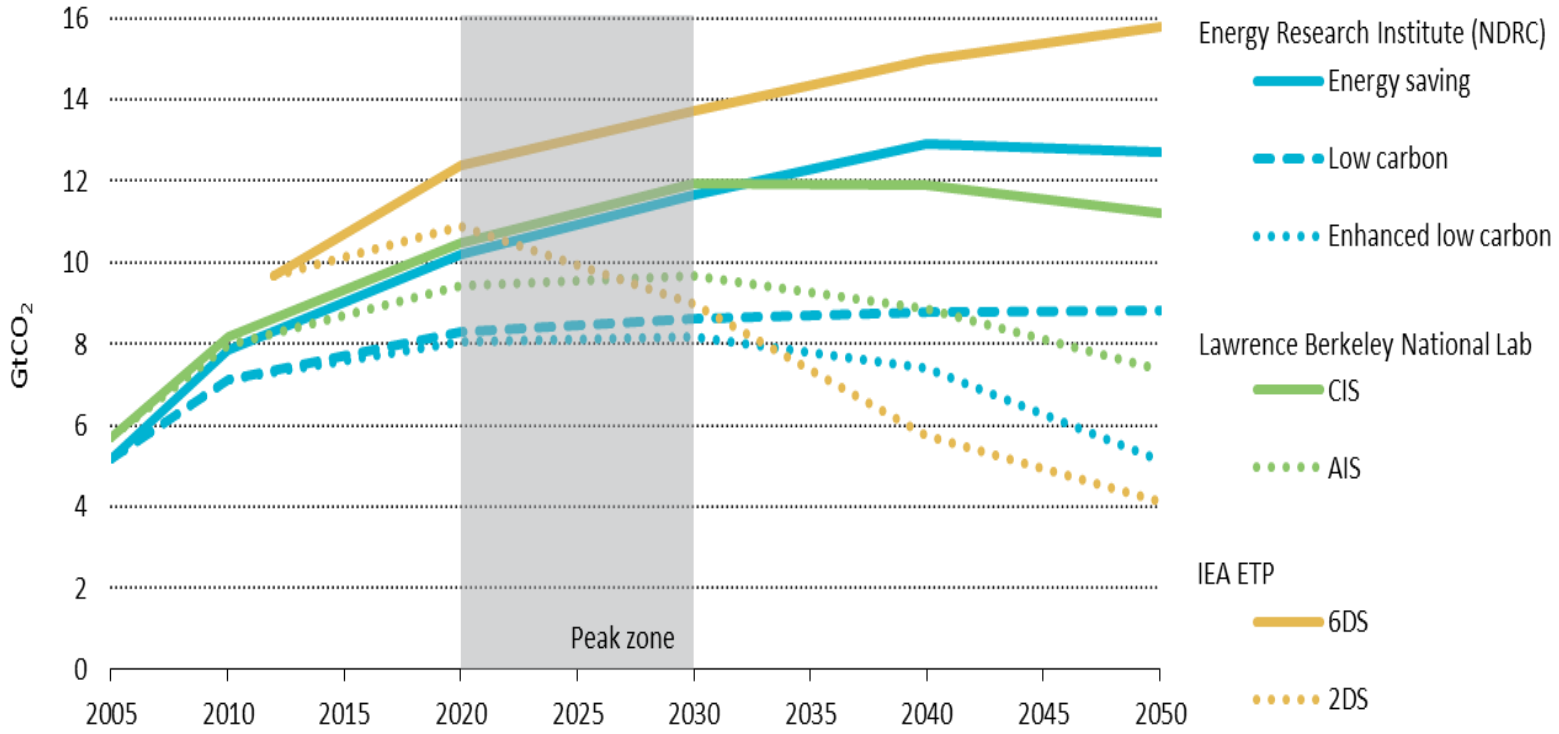
Long-term scenarios of China's 2030 emissions peak



China can make the 2Ds possible with strong policies encouraging energy technology innovation

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China is taking action to reap the benefits of a strong innovation system

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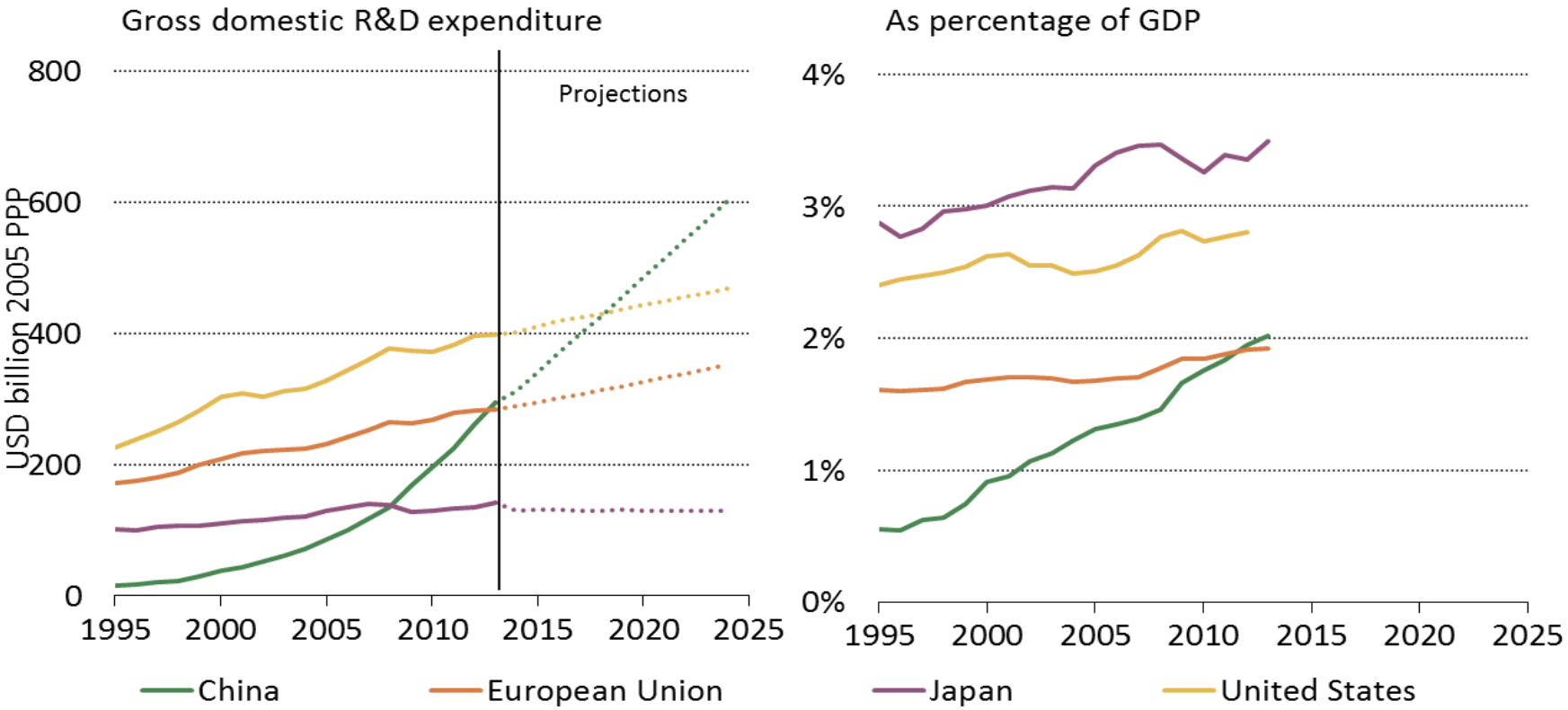
China's total R&D spending and OECD projections



China is poised to become the global leader in R&D spending by 2019.

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Better understanding innovation can increase confidence in its outcomes

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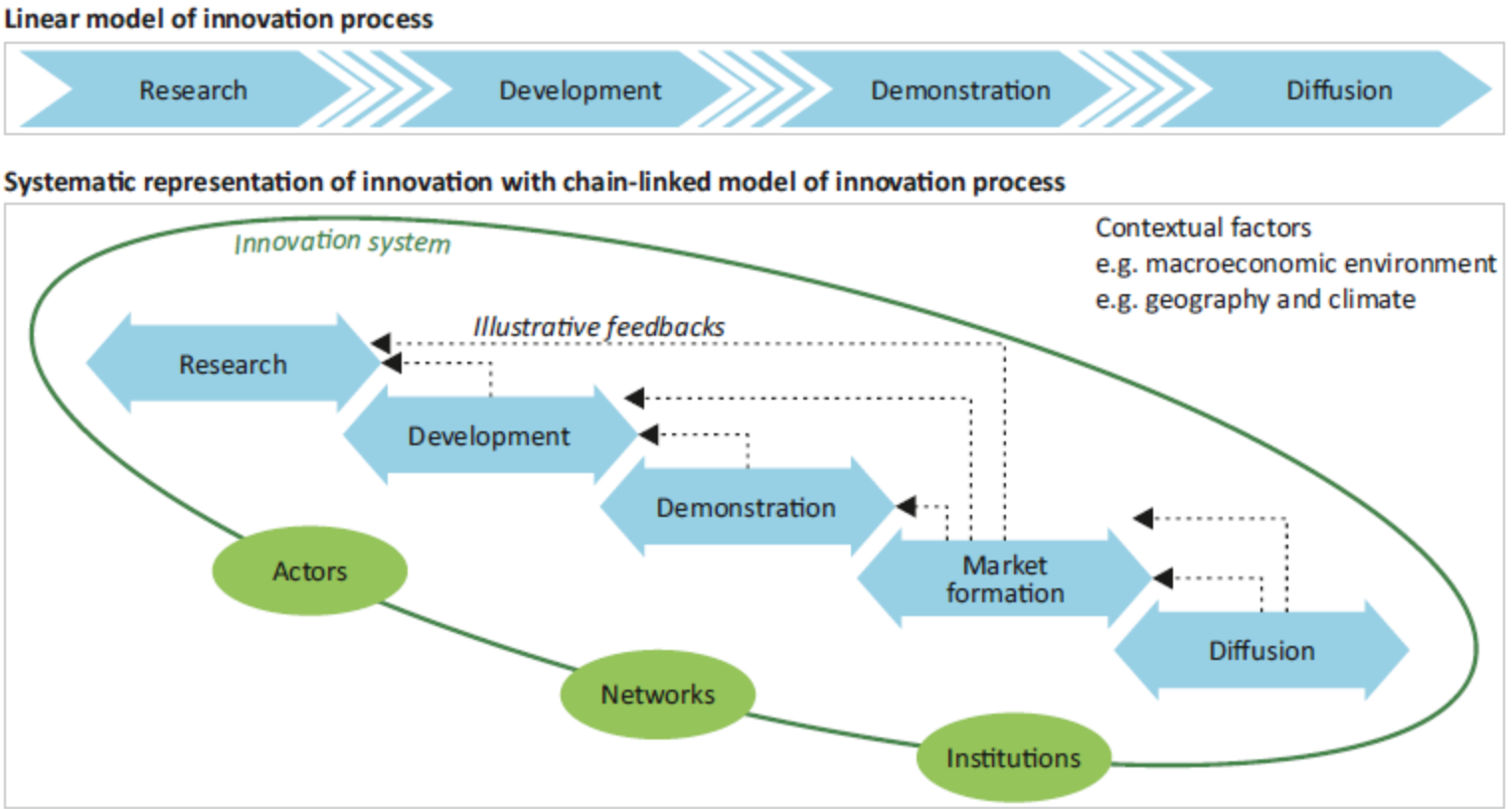

In order to accelerate technological progress in low-carbon technologies, innovation policies should be systemic

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ETP Publication Programme

ETP 2015

ETP 2014	ETP 2015	ETP 2016	ETP 2017
Part 1. Setting the Scene			
Global Outlook, Tracking Clean Energy Progress			
Part 2. Driving the Change (Thematic Focus) *			
Harnessing Electricity's Potential	Mobilising Innovation to Accelerate Climate Action	Building Urban Energy Systems	TBD • Securing sustainable resources • Investing in sustainable infrastructure
Partner Country			
India	China	Mexico	TBD (Indonesia; Russia; Brazil)

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IEA Technology Roadmaps

Mapping where we need to go…

2009 | **2010** | **2011** | **2012** | **2013** | **2014** | **2015**

Q2 2015
Hydrogen Fuel Cells

2016

Smart Grid Update

Low-Carbon Technology Roadmaps

... By building consensus among all stakeholders

- 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

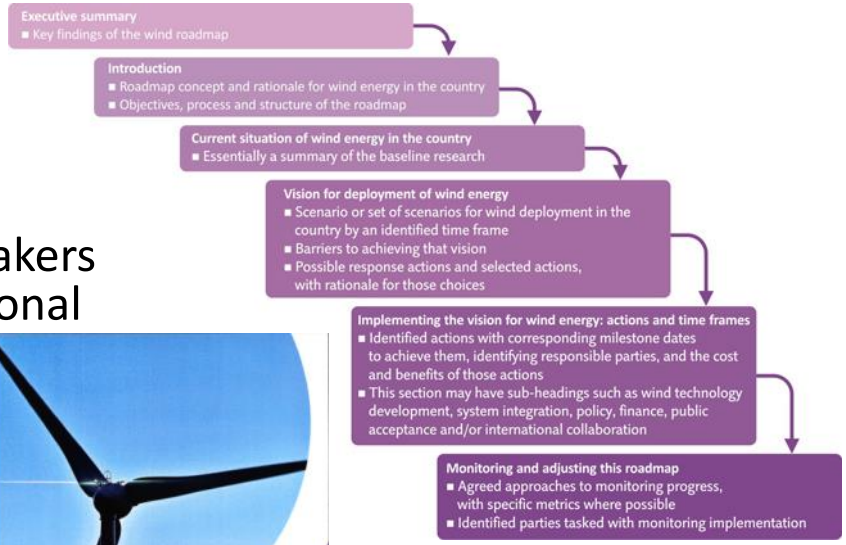
How2Guides principles

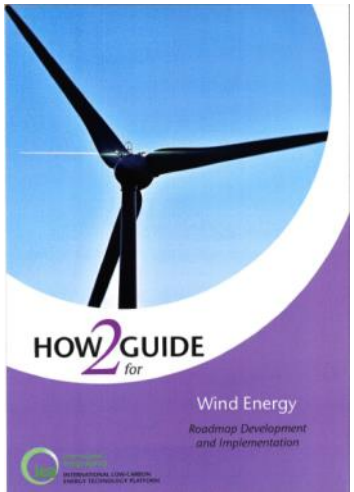
IEA Global Roadmap

Engages with public and private stakeholders to establish the barriers to technology deployment and the policies needed

IEA Technology Platform How2Guide

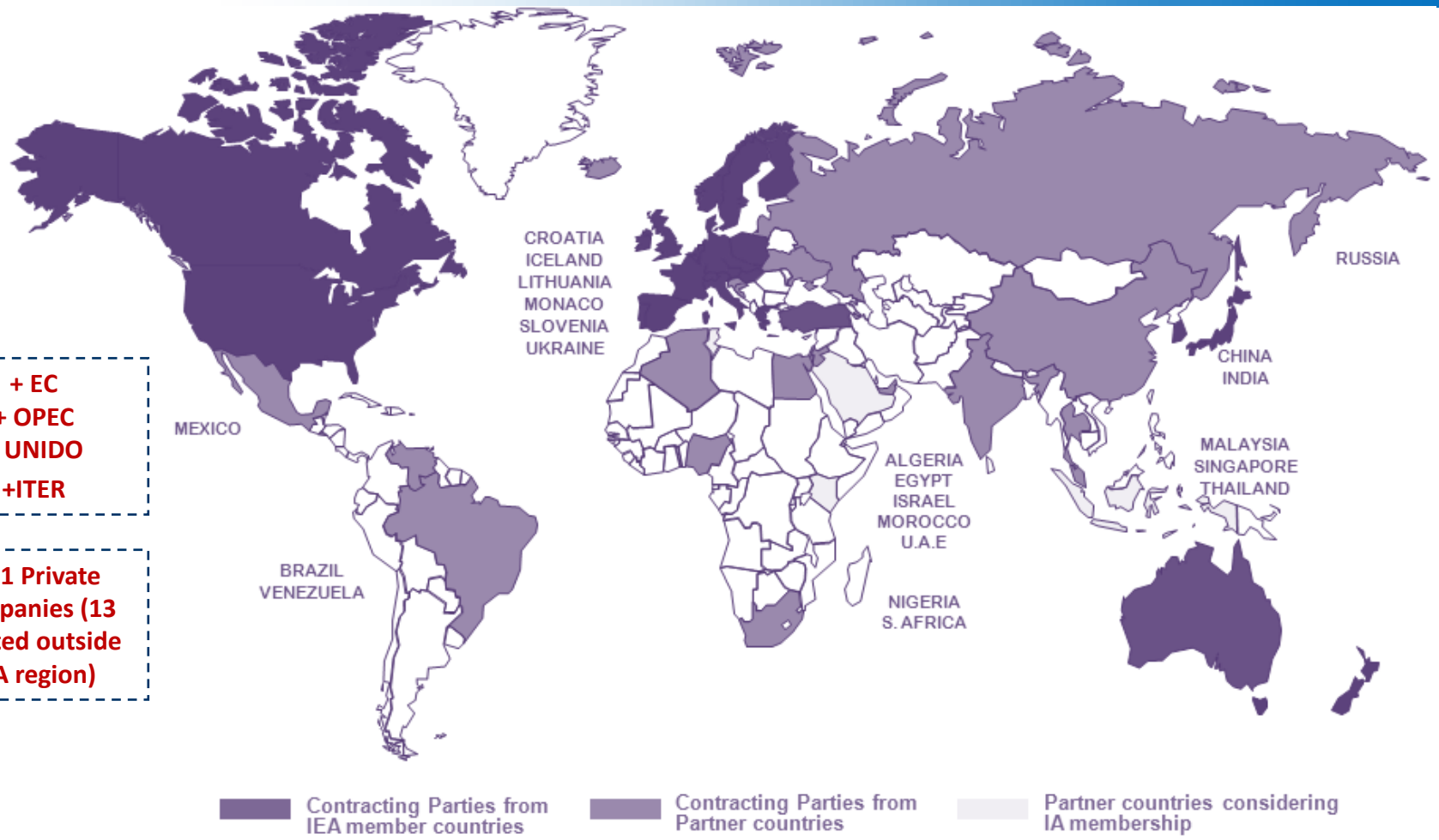
Provides practical information for policy makers and planners to establish a national or regional technology-specific roadmap





INTERNATIONAL LOW-CARBON ENERGY TECHNOLOGY PLATFORM

IEA Implementing Agreements (IAs)



+ EC
+ OPEC
+ UNIDO
+ITER

+ 61 Private companies (13 located outside IEA region)

More than 6,000 scientists and experts
Representing 500 government agencies, research organisations, universities, energy companies, industries, businesses, and consultants
Over 1,400 projects completed to date

Thank you

ETP 2015

Explore the data behind *ETP*

www.iea.org/etp

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INTERNATIONAL LOW-CARBON ENERGY TECHNOLOGY PLATFORM

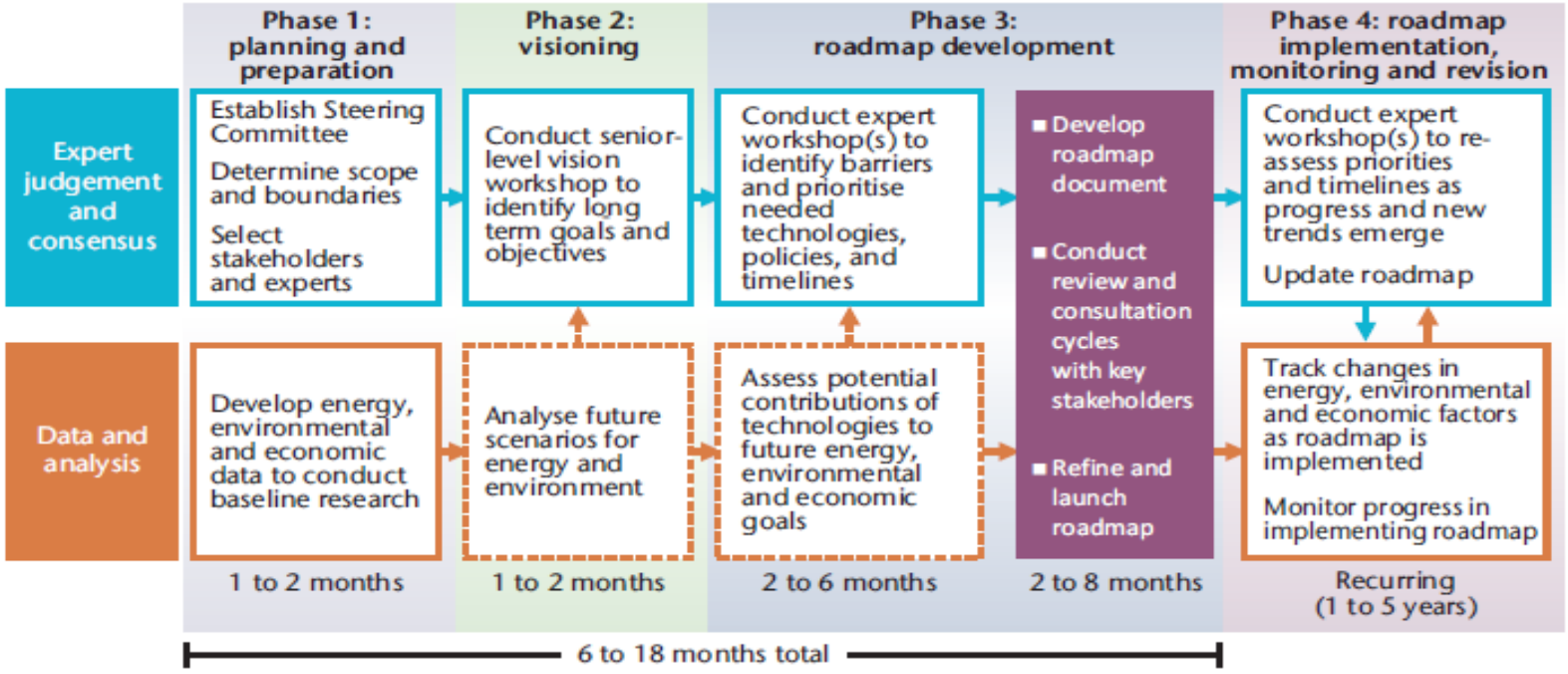
How2Guide for Smart Grids in Distribution Networks

Amanda Blank
Energy Technology Policy Division, IEA
29 May, 2015
Mexico City

www.iea.org

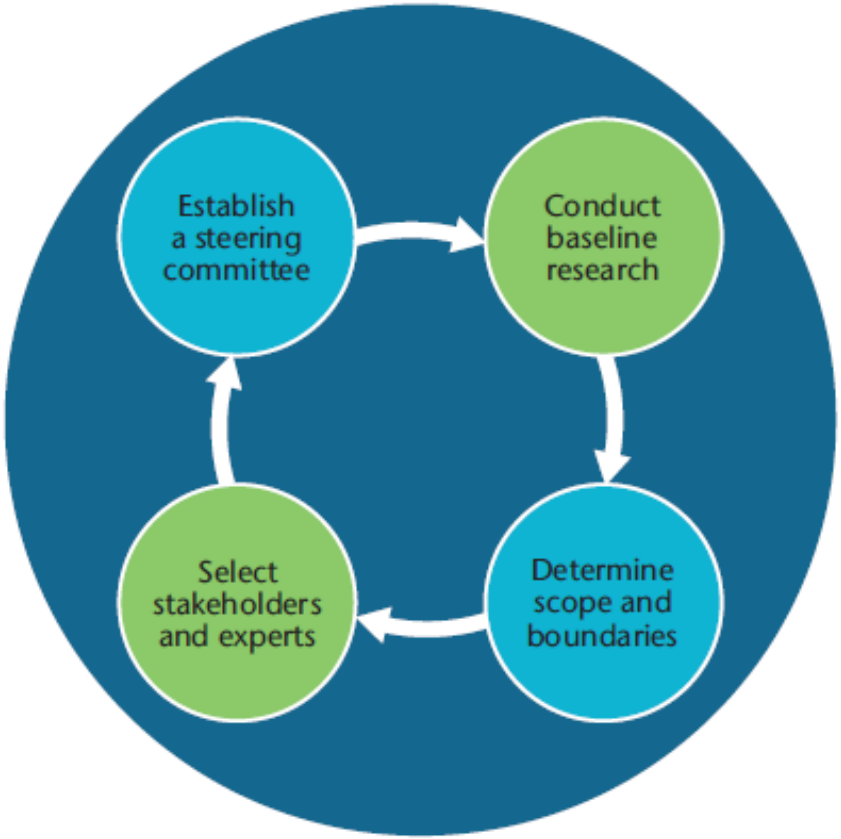
How2Guide framework

- **Provides tools and steps for decision makers to implement a strategic technology roll-out**



How2Guide for Smart Grids

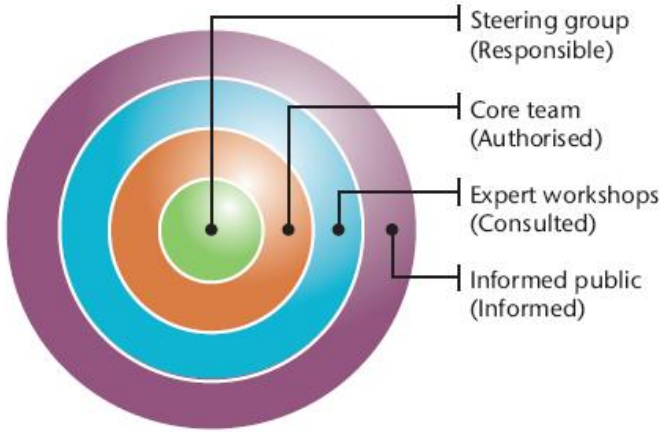
Phase 1: Planning and preparation



- Steering Committee identifies diverse range of stakeholders
- Conduct baseline research with guidance of key questions
  - Determine physical and institutional infrastructure that support technologies and enable deployment
  - Select additional stakeholders at varying phases and levels of technology deployment

Phase 1: Planning and preparation

Identifying smart grid stakeholders



A simple chart can help organise the stakeholders (RACI):

- **R**esponsible (final approval authority, “steering committee”)
- **A**uthorised (team responsible for the roadmap)
- **C**onsulted (stakeholders who attend workshops)
- **I**nformed (but not expected to provide inputs or feedback)

Phase 1: Planning and preparation

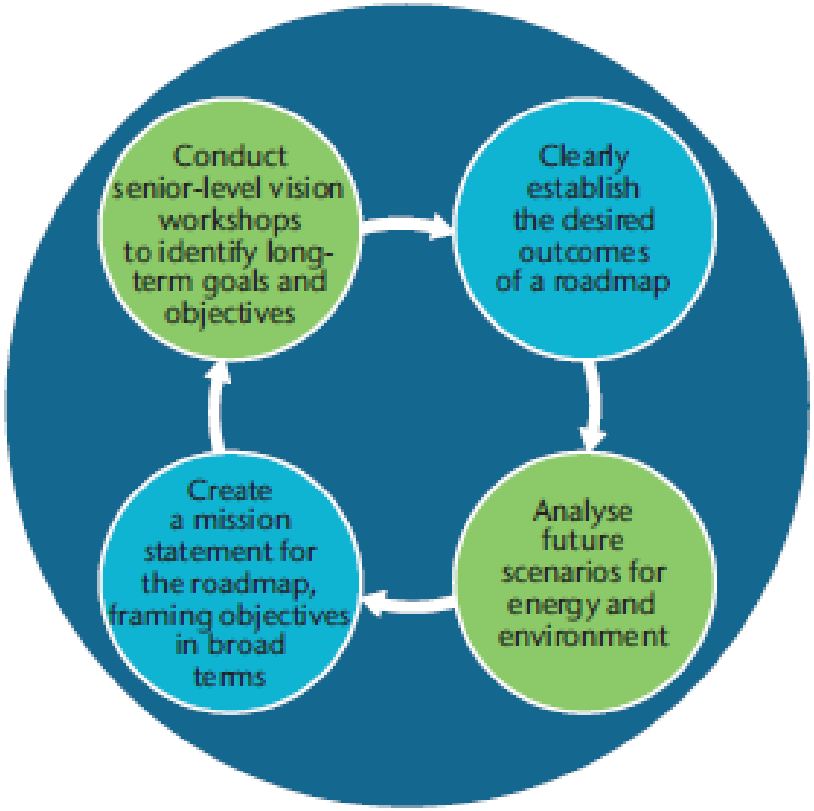
Baseline research

Key questions to help determine the scope and boundaries of a roadmap are divided into three categories of research:

- **1. Resources and technology**
- **2. Market and energy portfolio**
- **3. Public policy**

How2Guide for Smart Grids

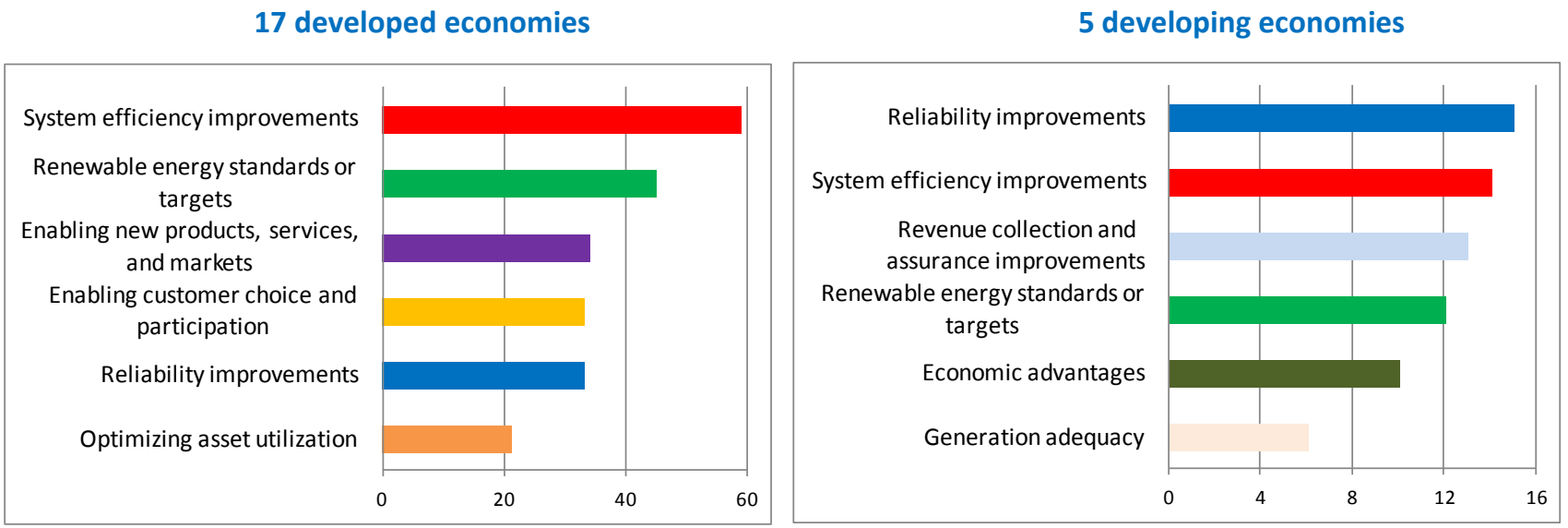
Phase 2: Visioning



- Determine long-term goals and objectives through stakeholder involvement
- Clarify drivers and consider project types that can meet national and regional needs
- Define desired outcomes of technology deployment
- Establish a mission statement taking into account objectives, national considerations and long-term strategies

Phase 2: Visioning

Figure 4 • Top drivers: ISGAN survey analysis of 22 countries



Source: adapted from ISGAN (2014), "Smart grid drivers and technologies by country, economies, and continent," ISGAN website, www.iea-isgan.org/index.php?r=home&c=5/378 (accessed 29 September 2014).

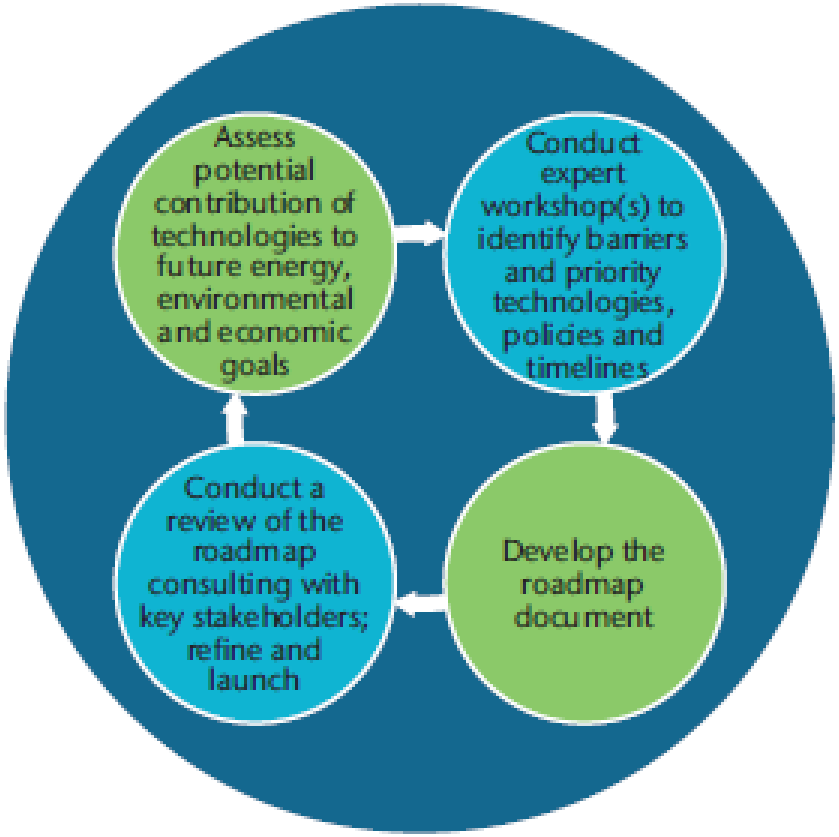
- AMI
- Distribution automation
- Customer-side systems
- DER-Storage
- DER-Distributed generation
- DER-Demand response
- Substation automation
- Asset management

Project type	Advanced Metering Infrastructure	Distribution Automation	Control Center Systems	Customer Side Systems	DER - Storage	DER - Distributed generation	DER - Demand response	Substation Automation	Asset Management
Driver									
Reliability									
Reliability improvements									
Power quality improvements									
Power restoration improvements									
Network adequacy									
Generation adequacy									
Efficiency									
System efficiency improvements (reduction in peak load, T&D losses, etc.)									
Optimizing asset utilization									
Energy efficiency improvements									
Enabling new products, services, and markets									
Enabling customer choice and participation									
Economic									
Economic advantages									
New revenues									
Revenue collection and assurance improvements									
Reducing operating and maintenance costs									
Environmental									
Renewable energy standards or targets									
Reduce carbon footprint									
Regulatory compliance									
Renewables									
Security									
National security concerns									
Enhanced power system resiliency to natural and human threats									
Safety									
Safety improvements									
Crosscutting									
Aging infrastructure concerns									
Rural electrification									
Job creation									
Increased flexibility									
Shifting ownership structures									
Consumer involvement									

Can address driver as a primary outcome of the project	
Can address driver as a secondary outcome of the project	
Can address driver to a small degree as a project outcome	

How2Guide for Smart Grids

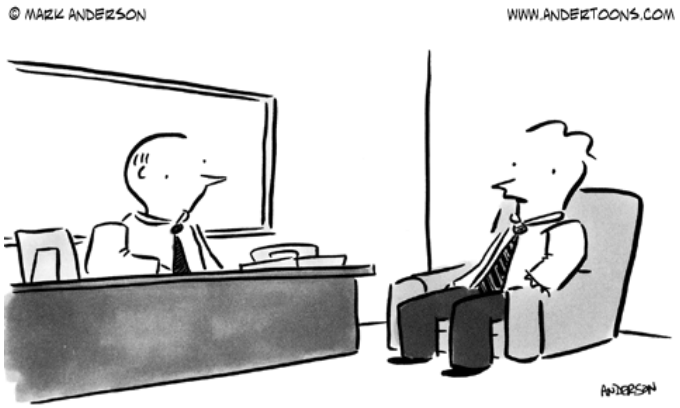
Phase 3: Preparing the roadmap document



- Assess the technology deployment in terms of holistic energy, environmental and economic strategies
- Identify potential barriers and correlated response actions
- Determine priority technologies that can meet objectives
- Develop a roadmap with stakeholder consultation, setting timelines and milestones

Identifying barriers

- **Barriers can be broadly categorised into five areas:**
- legal and regulatory
- project delivery and workforce capability
- economics and financing
- electricity market and systems aspects
- social and cyber security considerations



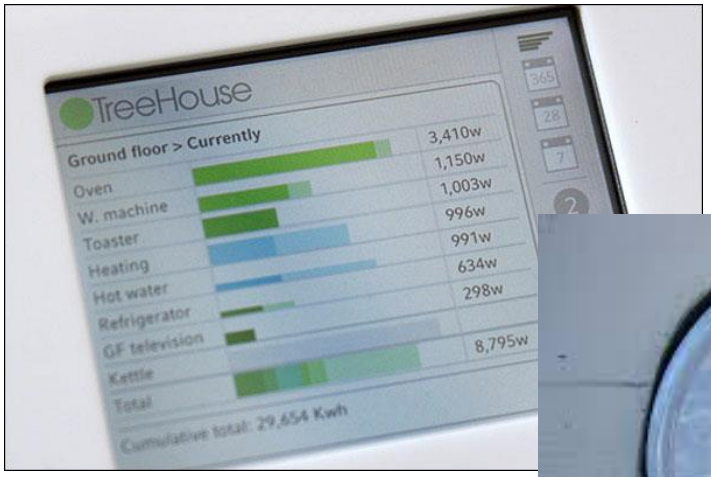
"We cut through all the red tape, but a new shipment came in this morning."

How2Guide for Smart Grids

Barriers and response actions

	Possible response actions																						
	Legal and regulatory				Project delivery and workforce capability									Economics and financing				Electricity market and systems					Social acceptance and cyber security	
Common barriers	Laws and regulatory strategic planning	Tariff restructuring	Revise ownership structure	Standard product requirements	Targeted installation	Management oversight	Local telecomm partnering	Design to recycle	Develop local workforce	Reskill technicians	Establish new training facilities	Attract qualified workforce from abroad	Adapt higher education curricula	Long-term financing	Private financing	Fiscal incentive schemes	Grants	Progressive installation pace	Support local industry development	Partner with global manufacturer for local production	Develop "open source" products	International partnering	ICT security solutions	Communication campaign
Financing/cost	x	x	x	x			x							x	x	x	x							
Project planning and delivery			x	x	x							x		x	x	x	x	x	x			x		
Technical/product solutions				x				x												x	x			
System operation aspects				x	x				x	x	x	x									x			x
Operations and maintenance				x	x				x	x	x	x	x						x		x	x		
Security/privacy	x			x			x			x	x	x	x										x	x
Legal and regulatory	x	x	x	x		x	x	x															x	
Human resources development					x	x	x		x	x	x	x	x	x			x	x	x	x		x		
Cross-cutting	x		x			x									x	x					x		x	x

Data ownership and privacy policies



How2Guide for Smart Grids

Phase 4: Implementation, monitoring and revision

- Strategic roll-out of selected technologies
- Develop a monitoring system with quantitative and qualitative indicators measuring success of implementation
- Track changes in other related sectors that influence roadmap implementation
- Re-evaluate and re-assess priorities, timelines and objectives; update the roadmap as necessary

Monitoring progress

Indicator type	Description	Metrics
Smart grid technology deployment	• Number of (pilot) projects implemented • Generation capacity connected to the smart grid • Reduction of losses • Consumer adoption of technologies	• Units • MW/GW • Comparison with pre-smart grid metrics • Number of consumers connected to the smart grid
Financial	• Grants and incentives available • Market expansion for smart grid technologies • Project financing with lending by financial institutions	• Total value of secured funds • Monetary growth over timeframe • USD
Processes	• Number of stakeholder workshops organised • Number of new institutions created • Effectiveness of awareness raising/campaigns organised	• Unit • Unit • Number of customers impacted by marketing or engagement strategies; qualitative assessment of customer acceptance
Policy	• Policies defined and adopted • Increase in political support • Milestones specific to sectoral strategies	• Unit; qualitative assessment of goals of policies and whether the right tools are being deployed • Qualitative assessment of policy makers' actions • Number of milestones being met
Socio-economic and environmental impact	• Social: jobs created; customer education/training • Environmental: CO_2 reductions; increased system efficiency	• Number of jobs and customers reached • Comparison with pre-smart grid metrics

How2Guide for Smart Grids

Conclusions

- **Highlights of the *How2Guide for Smart Grids in Distribution Networks*:**
  - **Step-by-step framework for roadmap development and implementation**
  - **Engage diverse stakeholders throughout all phases of planning and implementation**
  - **One size does not fit all. Take national/regional drivers into full account to identify the smart grid technology options that respond best to local needs**
  - **Monitor, re-evaluate and revise the roadmap—it is not a document to be "left on the shelf"!**

How2Guide for Smart Grids

Additionally…

- **The overarching message on smart grids is twofold:**
  - (1) Smart grids are advanced technologies to **improve overall system efficiency** and options, including greater integration of **renewable energy** sources.
  - (2) Smart grids can be an infrastructural catalyst for enabling **energy sector transformation**, including supporting **sustainable urban development**.

Thank you!

- The *How2Guide for Smart Grids in Distribution Networks* will be available at iea.org for free download.
- IEA roadmaps: www.iea.org/roadmaps/
- IEA How2Guides: www.iea.org/aboutus/affiliatedgroups/platform/how2guides/
- Contact: amanda.BLANK@iea.org