

Incentives for CCS and Regulatory Requirements

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Ellina Levina
Carbon Capture and Storage Unit
International Energy Agency

POLICY & REGULATION: CRUCIAL ROLE

1. Strategic vision and defining the role of CCS
 - Enabling CCS as part of energy portfolio
2. Development of a legal framework
 - Making CCS a legal activity & clarifying responsibilities
 - Ensuring safety and environmental viability of operations
3. Providing incentives for demonstration and deployment
 - Business models & financing of projects
4. Information, education, discussions
 - Contributing to public acceptance

SETTING STRATEGIC POLICY DRIVERS & DIRECTION

- Making firm decisions to address **climate change**
- Improving **understanding of CCS** and its role within the broader technology portfolio
- **Recognition** of the role of CCS
- **Planning** for the future
- More attention to **industrial CCS** applications

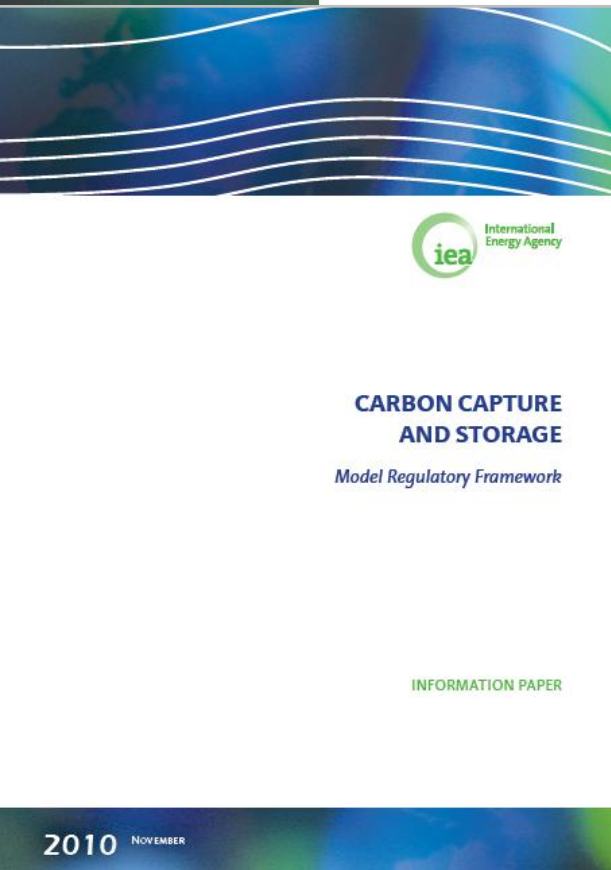
LEGAL/REGULATORY FRAMEWORKS

- Many OECD countries have implemented, or are implementing, **legal & regulatory frameworks**
 - Safety & environmental effectiveness
 - Long-term liability
 - Ensuring public engagement
- Many **non-OECD countries** are lacking CCS-related regulations
- Dealing with outstanding **international legal issues**
 - ratification of the London Protocol and OSPAR amendments
 - Inclusion of CCS in CDM activities under the UNFCCC

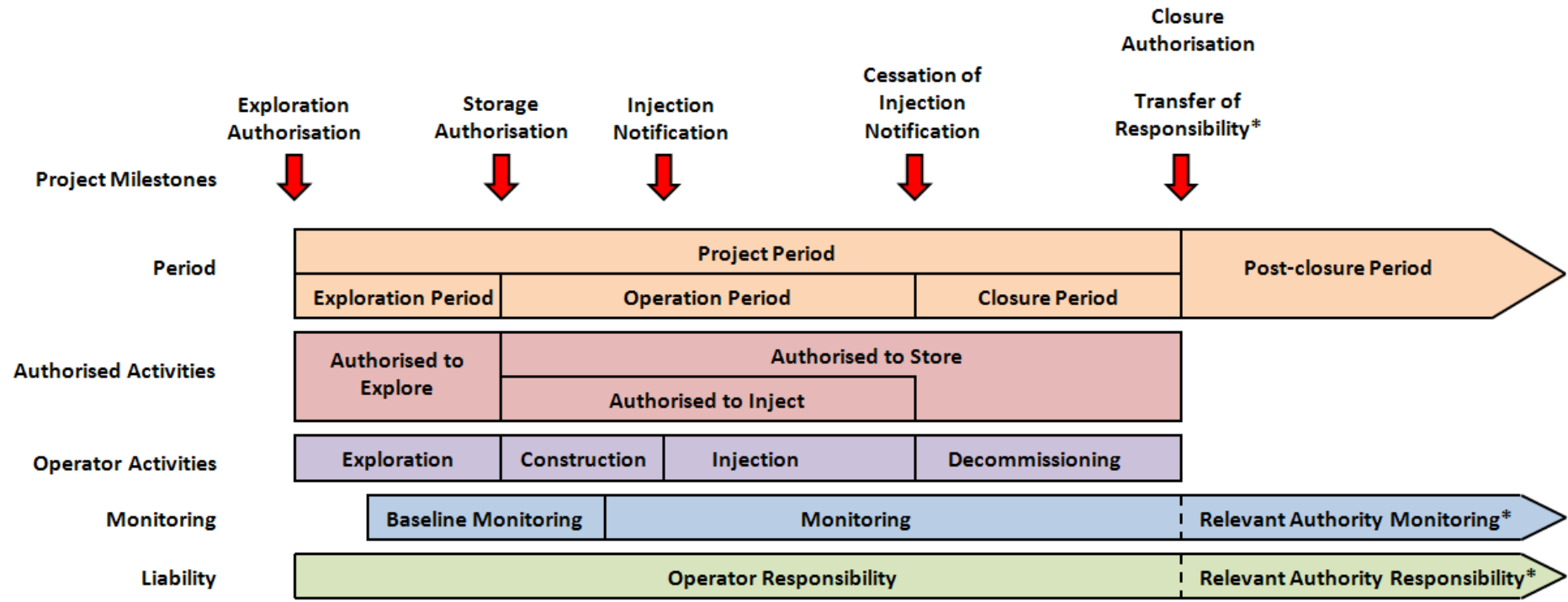


IEA Model CCS Regulatory Framework 2010

- Regulatory development process
- Capture, transport and **storage**
- 29 key issues, including:
 - **Property rights; Protecting human health;**
 - **Authorisation of storage site exploration activities;**
 - **Regulating site selection and characterisation activities;**
 - **Monitoring, reporting and verification requirements;**
 - **Liability, Corrective measures,**
 - **Authorisation for storage site closure**



Life-cycle of CO₂ storage in Model Framework



* Where long-term responsibility is transferred to the Relevant Authority

STATUS OF CCS COSTS

CO₂ Capture from power generation (IEA, 2011)

Fuel (capture route)	Coal (similar for all capture routes; relative to a pulverized coal baseline)	Natural gas (post-combustion)
Capital costs	3 800 USD/kW (74% increase)	1 700 USD/kW (82% increase)
Cost of CO ₂ avoided	55 USD/tCO ₂	80 USD/tCO ₂

Notes: Averages figures for OECD countries shown (costs in China estimated to be about half for most cases), capital costs are overnight costs

CO₂ Capture from industrial application (UNIDO, 2010)

Refining sector 28-96 €/tCO₂

Cement plant 36-107 €/tCO₂

Pulp and paper 30-40 €/tCO₂

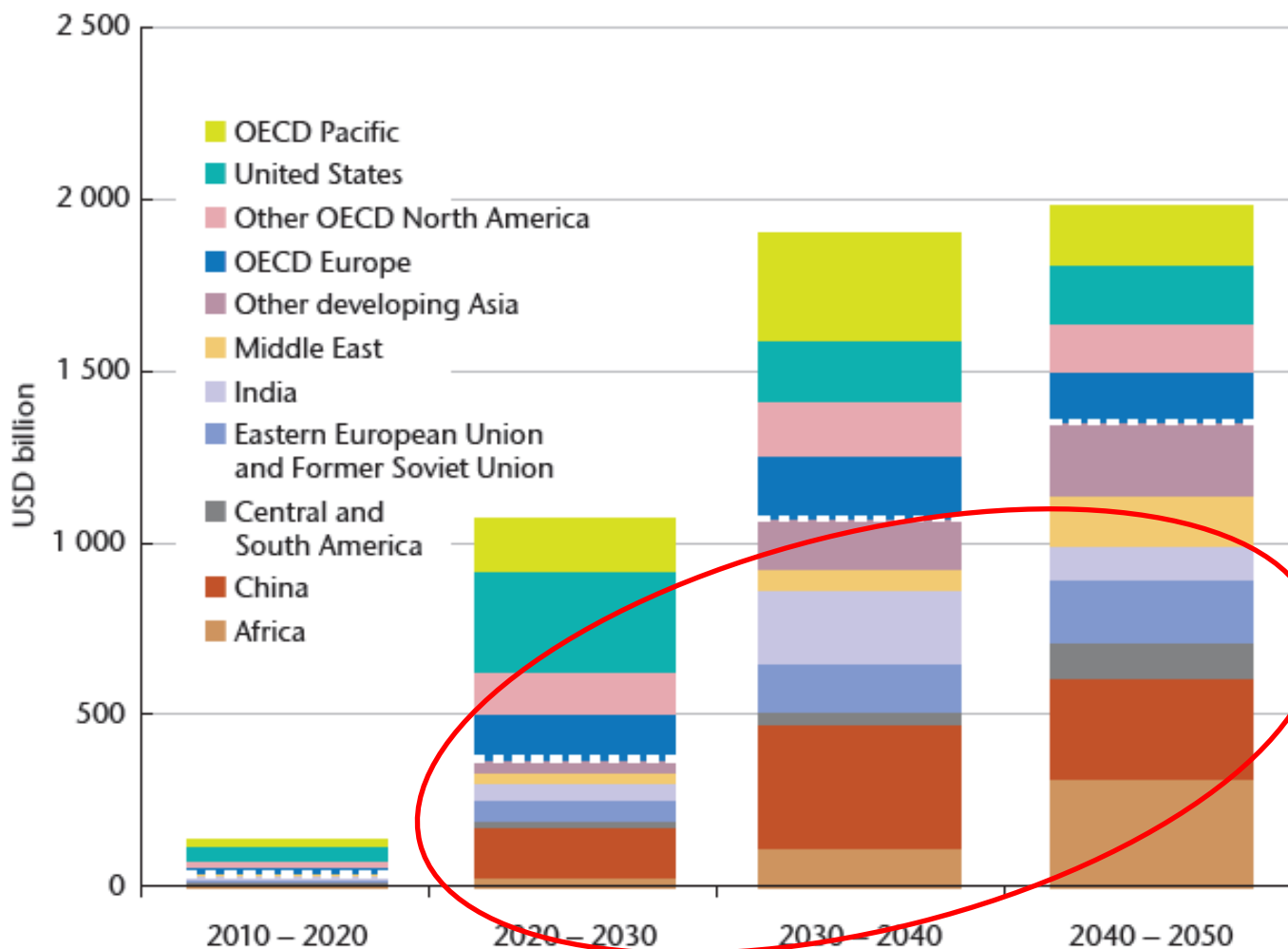
Iron & Steel 30-40 €/tCO₂ (Kuramochi, 2011)

CO₂ transport & storage

Very site-specific; likely additional costs of about 20 USD/tCO₂

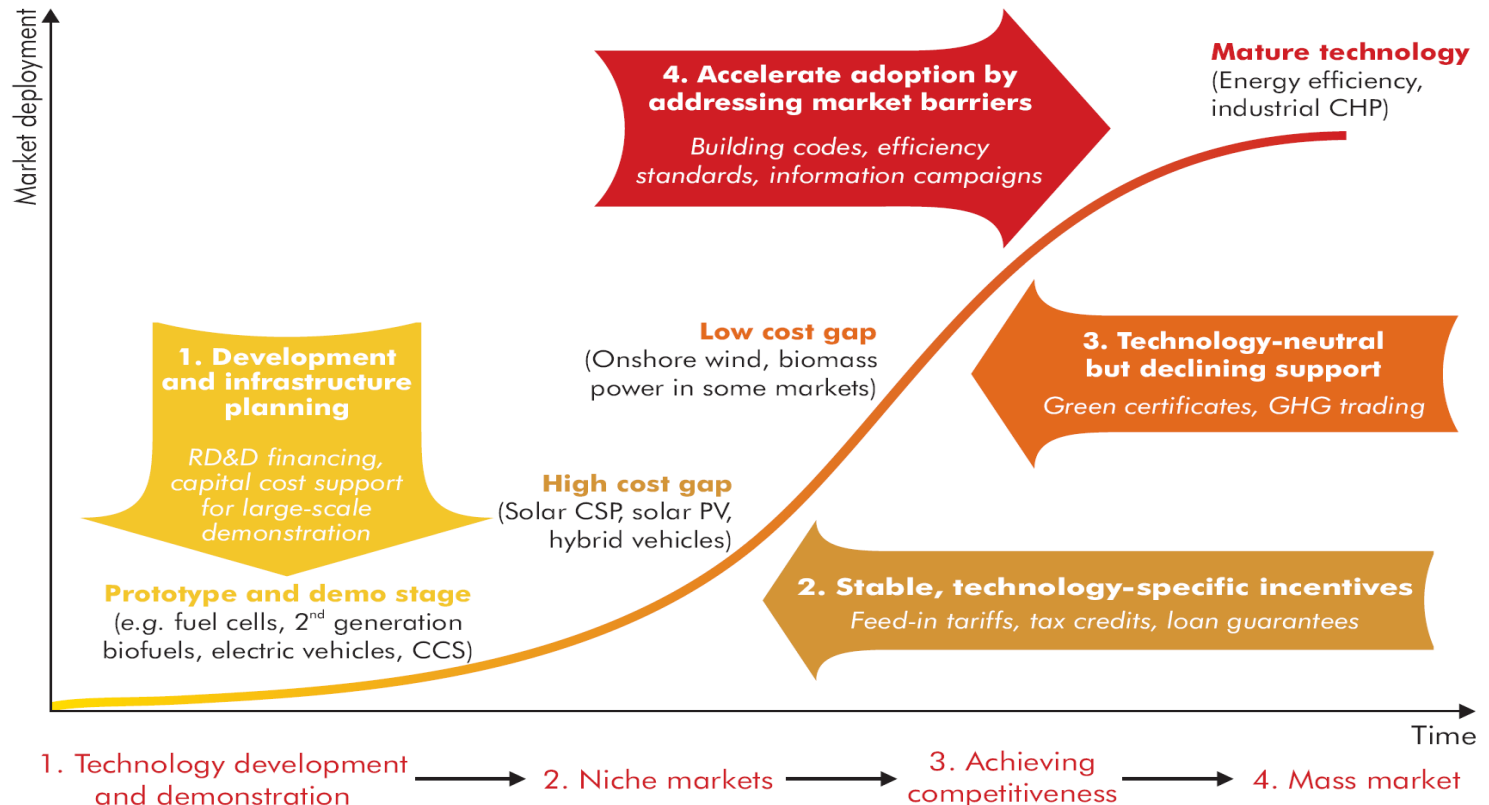
LONG-TERM INVESTMENT NEEDS

- Long-term: mobilising **2500 – 3000 bn USD** investment in capture plant, transport and storage between **2010-2050**
- **1400 bn USD** investment in **non-OECD countries** 2010-2050



CREATING INCENTIVES

- Time dimension: R&D → Demonstration → Deployment
- Geographic dimension: OECD vs. non-OECD world



EXAMPLES OF POLICY TOOLS

- **CCS mandate or emission performance standard**
- **CCS quota obligation with or without trading**
- **Price-based support schemes (like feed in tariffs)**
- **Grants or tax breaks**
- **Carbon price**
- **International cooperation**

MARKET FAILURES AS RATIONALE FOR POLICY INTERVENTION

Market failure

Example policies

Emissions externality

Carbon pricing (carbon tax or emissions trading scheme), emission performance standard

'Learning by doing'

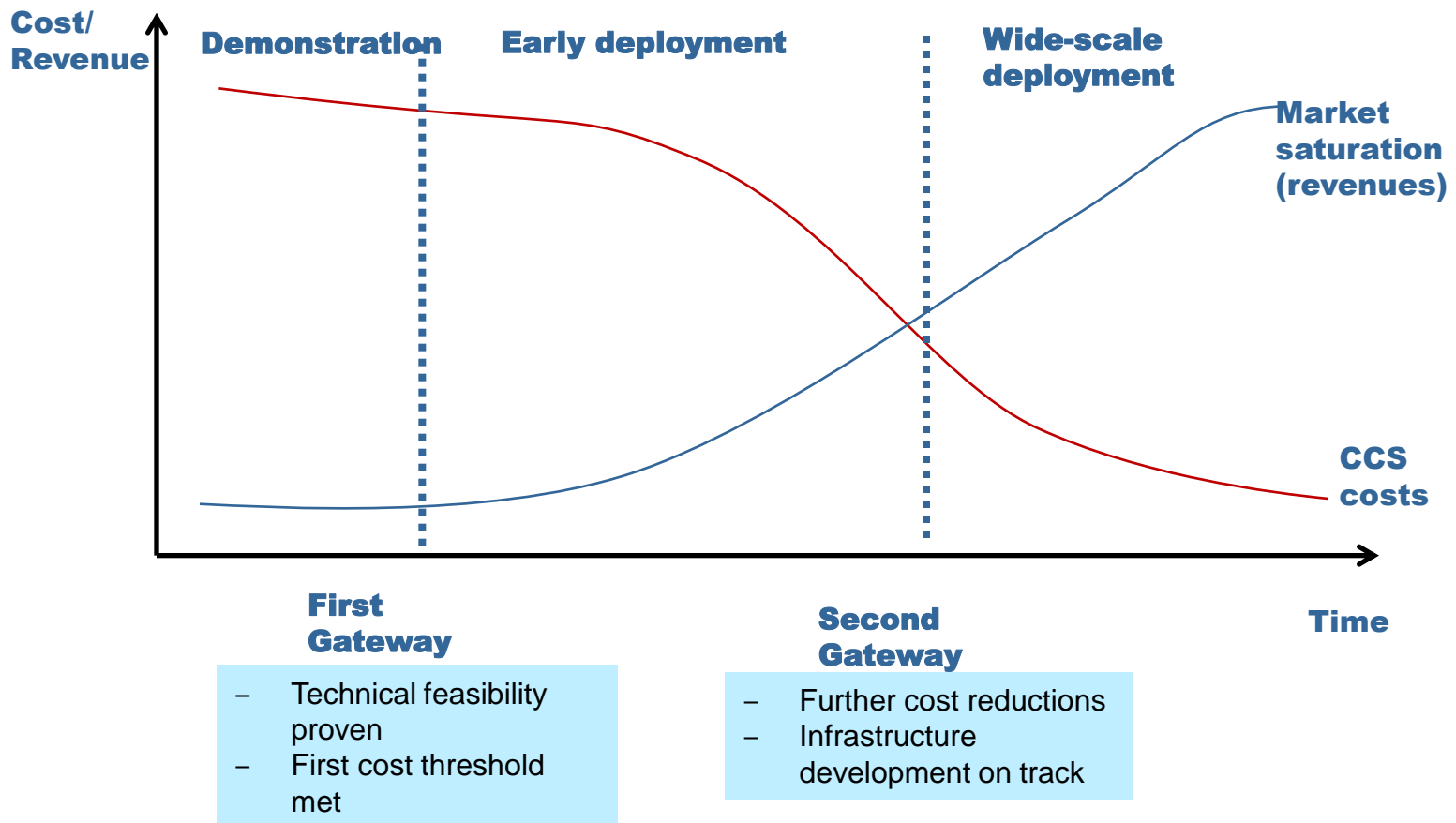
quantity-based instruments: feed-in tariff, portfolio standards (CCS quota obligations), emission performance standard, international cooperation

Risk and capital market failure

provision of debt/equity, grants, investment tax credits, insurance, feed-in tariff, international cooperation

POLICY GATEWAYS

- Policy evolution could be mapped on a series of explicit policy gateways
- Provides investors with a greater degree of policy certainty



CONCLUSION: KEY NEEDS

- **Strategic long-term vision for the energy sector under climate constraints**
- **Evolving policy incentives**
- **Legal frameworks**
- **International cooperation**



Thank you!

Ellina.levina@iea.org

+33 1 40 57 67 03

www.iea.org/ccs

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AND STORAGE**