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International Energy Agency

From demonstration to deployment: support policies for CCS

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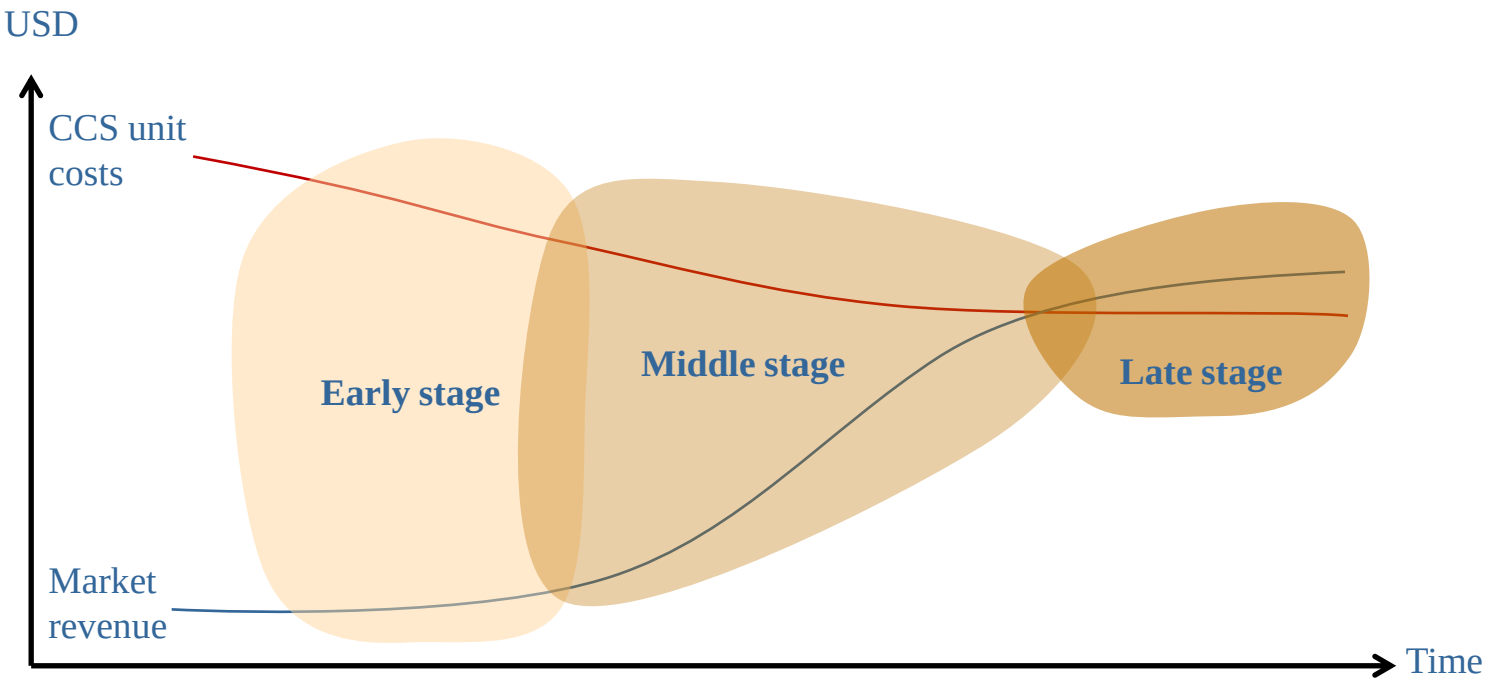
The starting point: Economic characteristics of CCS technology will change with time



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Markets failures produce outcomes that are not socially optimal

CCS-relevant market failures

- **Externality**
  - Atmosphere is scarce resource - overused when not priced accordingly
- **Public good**
  - Underinvestment results when returns from technology learning can only be partially appropriated by investor
- **Imperfect information**
  - Difficulty of early investors to distinguish good from bad projects may hinder access to capital markets
- **Complementary markets**
  - Underprovision of CCS due to lack of certainty about the provision of transport and storage infrastructure

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Market failure as rationale for intervention

Market failure	Example policies
Emissions externality *Failure to internalise the cost of greenhouse gas emissions*	Carbon tax or emissions trading scheme
Public good *Failure to appropriate returns generated by investments in innovation*	*Quantity*-based instruments: feed-in tariff, portfolio standards
Risk and capital market failure *Underprovision of private capital resulting from imperfect information*	Provision of debt/equity, grants, investment tax credits, insurance
Complementary markets Undersupply due to dependency on complementary markets and coordination failure	Regulation

Sorry for the jargon

An economy-wide carbon price is the most efficient way to tackle the emissions externality

- Either a carbon tax or emissions trading scheme can provide a price
  - Taxes provide more stable carbon price, making return on CCS investment more certain
  - political economy considerations have tended towards creation of trading schemes

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Risk of policy failure is particularly acute in creating carbon price

- Investors may question whether carbon pricing policy will persist in the long term
- Other policy instruments, i.e. feebate, emissions performance standard may be used in cases where a sector-specific approaching to controlling emissions is preferred

Feebate: carbon tax applied to emissions above certain baseline, combined with payments if emissions are below baseline

Emission Performance Standard: prescribes acceptable emission level per unit of output

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Purchasing knowledge

- **High-risk of early demonstration projects suggests grant-funding may be best**
  - **but this is not sustainable in the longer run**
- **Feed-in tariff for CCS**
  - **a 'top-up' to the electricity price eliminates uncertainty due to variable fossil-fuel prices**
- **Portfolio standard**
  - **may support the development of CCS infrastructure**
  - **threshold effects**
- **CO_2 purchase commitment**
  - **Minimises risk of leakage/decline in industrial competitiveness**

***Feed-in tariff*: long-term contract between power producers and, distributers to sell electricity at fixed, pre-determined price**

***Portfolio standard*: obligation on electricity generators to use CCS to produce specified fraction of output**

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Public sector instruments to overcome capital market failure

- In early stages of CCS, capital markets may be unwilling to provide sufficient capital
- Public sector can either
  - make direct capital contributions
  - provide risk mitigation instruments
- Financial Institutions may be better able to provide these instruments than governments themselves

Steering the development of CCS infrastructure

- Risk of stranded assets
- Governmental role in electricity transmission and distribution network provides model
  - Regulation, public supervision
  - Underwriting portion of fixed network cost

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Some criteria for good policy making

- **Effectiveness**
  - Is policy instrument able to achieve its objective?
    - Application across different sector
    - Strength of incentive to invest in abatement
- **Efficiency**
  - Does policy encourage least-cost abatement option?
- **Ease of application**
  - Informational and institutional requirements?
- **Political acceptability**
  - High political acceptability - low policy risk

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Multiple policy objectives justify a suite of interventions

- As CCS development is affected by multiple market failures, multiple support policies can be justified
- No more than one policy instrument to tackle each market failure
- Beware of policy interactions
  - If CCS is incentivized via emission trading, supplementary support (via CCS certificate scheme and others) may lead to a lower price on emissions covered by the ETS

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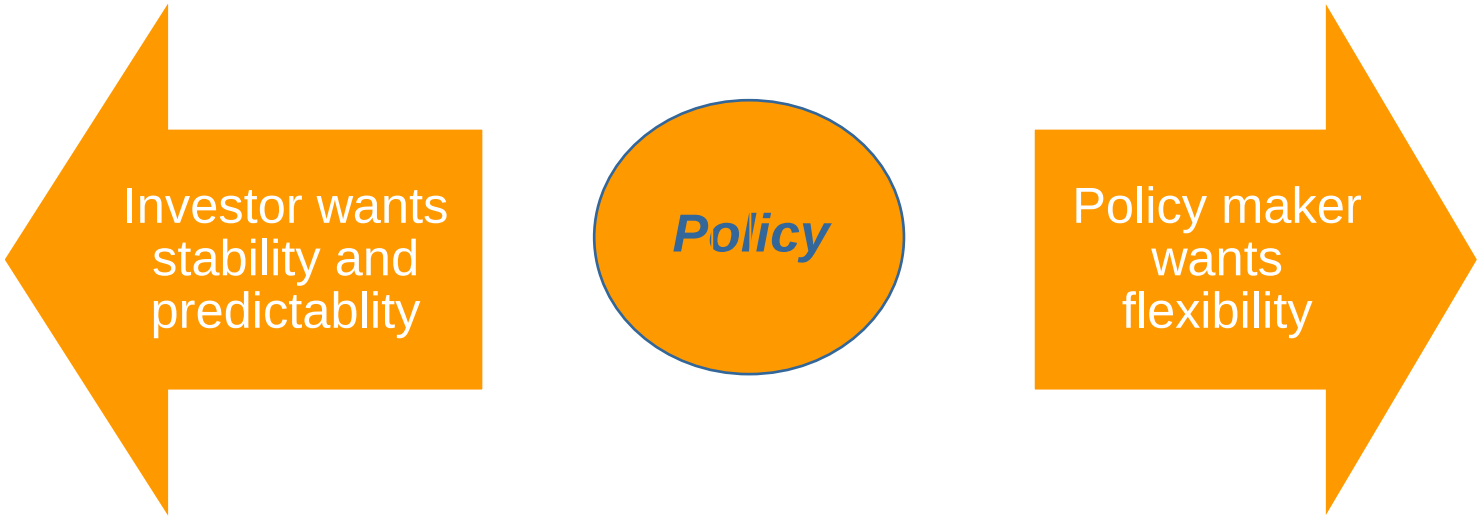
The policy dilemma

- **Change in the characteristics of CCS, and associated focus of incentive policy, creates a challenge for policy-making**
  - **on the one hand, want to be able to adapt and modify policy as technology changes or new information comes to light**
  - **on the other hand, the (perception of) changing policy may damage investment**



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Policy gateways to reconcile flexibility with stability

- 'Policy gateways' might help overcome this challenge;
- Gateways would consist of three components
  - policies that will be used in each stage
  - criteria that will define when or if policy will move to the next stage
  - an outline of the reaction if gateways are missed
- Protects government from overstretching resources, from imposing poor value for money, and lowers policy risk for investors

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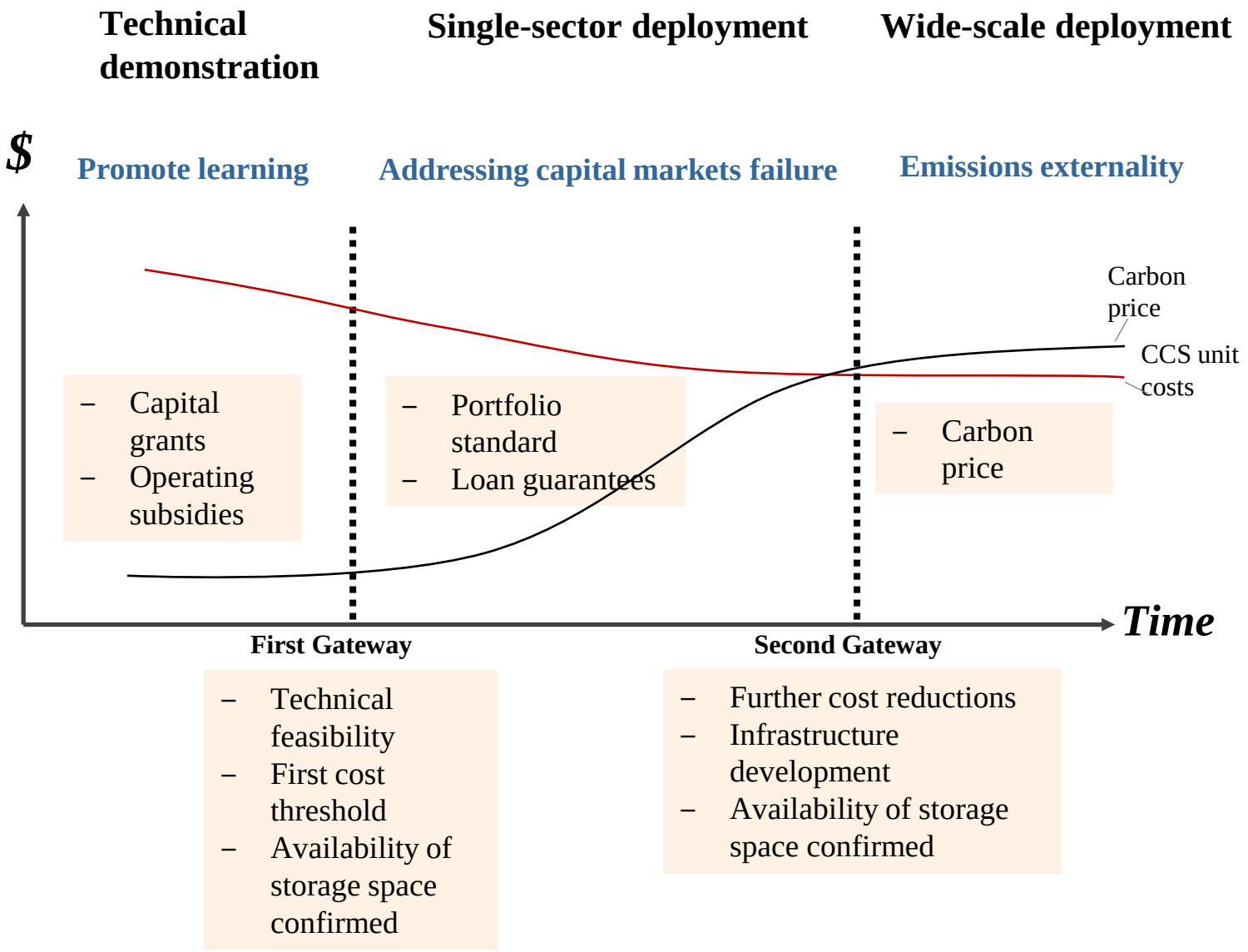
Policy gateways in action



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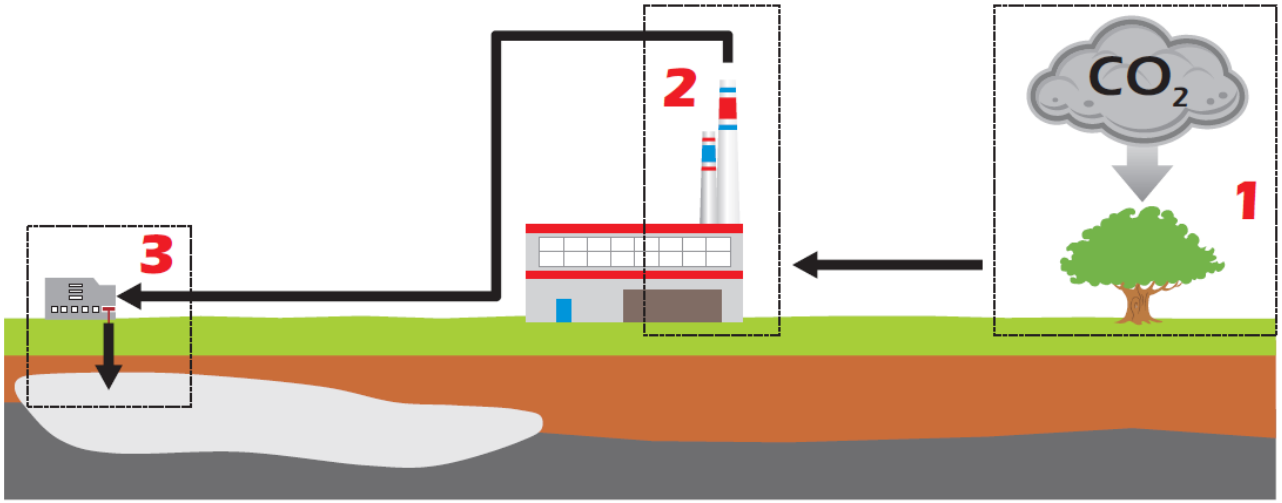
BECCS: Combining bioenergy with CCS



Storage

Capture

Biological sequestration

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BECCS can create 'negative emissions' that can *reduce* atmospheric concentrations of CO_2

- This should be reflected in incentive policy
- BECCS is the use of CCS to capture emissions from biomass processing or combustion
- it has the potential to reduce atmospheric concentrations of CO_2
  - CO_2 sequestered from air as biomass grows is not returned to atmosphere
  - may well be needed for climate stabilisation

Stylised comparison of conventional CCS and BECCS lifecycle emissions

Process	CCS	BECCS
Biological sequestration		-1
Combustion	+1	+1
Storage	-1	-1
Lifecycle emissions	**0**	**-1**

Should be reflected as extra incentive

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Thank you

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