

Energy Resources in the Arctic: Some Implications of the Kyoto Protocol and its Flexible Mechanisms

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The Kyoto Protocol: Objectives & Measures

- Quantified Emission Reduction Targets
 - ✓ Annex B
- Flexible Mechanisms:
 - ✓ The Clean Development Mechanism
 - ✓ Joint Implementation
 - ✓ Emissions Trading

Clean Development Mechanism

- Purpose
 - ✓ Assist non-annex I countries "in achieving a sustainable development and in contributing to the ultimate objective of the Convention"
 - ✓ Assist annex I countries in achieving compliance with their emission targets
- Implementation
 - ✓ The CDM project cycle
- Credits
 - ✓ CERs

Joint Implementation

- Purpose
 - ✓ To reduce emission by sources
 - ✓ To increase removals by sinks
 - ✓ Annex I → Annex I (annex II → EIT)
- Implementation
 - ✓ Verification by host
 - ✓ Independent procedure
- Credits
 - ✓ ERUs

Emissions Trading

- Purpose
 - ✓ To provide opportunities for cost-effective emission reductions; i.e., that measures are undertaken where they are least costly...
 - ✓ Emission target inscribed in Annex B
- Implementation
 - ✓ Cap-and-trade
 - ✓ Compliance: one allowance for every emitted ton of CO₂

Energy Resources in the Arctic

- The Arctic is rich in energy resources:
 - ✓ Immense reserves of renewable as well as non-renewable energy sources
- So far, exploitation mainly hindered by "absolute" and "relative" inaccessibility
 - ✓ Physical obstacles such as weather conditions, topography etc.
 - ✓ High costs involved in e.g., transports, grid reinforcement etc.

Natural Gas

- Substantial reserves all over the Arctic regions
- Favourable Kyoto compliance strategy
 - ✓ Emission reductions
 - ✓ Costs
 - **Incentives for further exploitation**
 - **Efficiency and replacement options**
- Possibly obstructive factors:
 - ✓ Climate change impacts:
 - Damages on existing and planned (future) infrastructure, e.g., transport settings and pipelines etc.

Wind Energy

- Great resource potential
- Favourable option to reduce CO₂
 - ✓ Non-emitting energy resource
 - ✓ Decreasing costs
 - ✓ Strong support
- General constraints
 - ✓ Siting issues; lack of grid → high capital costs
- Climate change related constraints
 - ✓ Extreme weather conditions; storms, melting ice, thawing permafrost etc.

Hydropower

- Great resource potential
- Considerably built out across the Arctic
- Possible constraints
 - ✓ High capital costs
 - ✓ Institutional restrictions
 - ✓ Public opposition
- Options
 - ✓ Small-scale hydro
 - ✓ Efficiency measures

Other Renewables

- Ocean energy resources
 - ✓ Tidal (& wave) energy
- Obstacles towards development
 - ✓ High capital costs
 - ✓ Technological constraints
- Photovoltaic power systems (PVPS) (Solar)
 - ✓ Remote applications, not competitive
 - ✓ Wider applications expected in the future

Conclusive Remarks

- Further exploitation of Arctic energy resources a possible outcome of:
 - ✓ **Climate change**
 - ✓ **The Kyoto regime:**
 - E.g, emission reduction targets & flexible mechanisms imply (in short):
 - ✓ increased costs for traditional fossil fuels and thus:
 - ✓ improved economic potential for e.g., wind power, hydropower and natural gas