

Internalisation of External Costs for Electricity Generation

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**MAXIMA and the ExternE Method:
Stakeholder Reactions & Reservations**

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Overview of the presentation

- Command and control Instruments
- Market based instruments
 - Carbon tax
 - Tradable permits
 - Subsidies
- Voluntary agreements
- Voluntary measures
- Criteria for choosing the optimal policy instrument(s)

Command and Control: Technology-based

- The regulator specifies the methods and equipment that firms must use to meet the target.
- This policy does not stimulate firms to increase research efforts towards new technologies because the latter are provided by the government.
- The positive element is that information on the best technology (provided by the regulator) is spread in the economy and all firms have access to it.

Command and Control: Performance-based

- The regulator sets an overall target for each firm, or plant, and gives firms some discretion in how to meet the standard.
- Technology forcing standards demand a performance (energy consumption level, emission level) that is not feasible with the existing technology.
- The requirements induce firms to invest in developing innovative technologies.

=> little flexibility in meeting environmental standards

=> industries invest to meet the standard and then stop

Carbon Tax

- Compulsory tax levied on fuels in accordance with their carbon content, with the aim to encourage using less carbon-intensive fuels and to reduce energy consumption (European Environment Agency).
- The objective of a carbon tax is to internalise the external cost of CO₂-pollution into the price of fossil fuels.
- Double purpose of collecting revenues and try to influence the behaviour of the economic agents.

Carbon Tax cont.

- A pollution tax is not specific, i.e. its revenues are not allocated to any special purpose but go to the general State budget.
- There would be significant variation in timing and size of the carbon taxes among countries and regions, given that the marginal cost of abating CO₂ emissions substantially differs across countries and over time.
- The autonomous (i.e. non-price-induced) energy efficiency improvement, the possibilities for fuel substitution, and the availability of backstop technologies are essential elements in determining the evolution of the tax rate over time.

Carbon Tax cont.

- The tax is part of the electricity price. The consumer, who is supposed to change his or her behaviour, will not be aware of it in a transparent way (Kunsch et al, 2004).
- If a tax is designed to fully internalize the external costs of electricity production, taxing the damaging fuels and technologies will result in a **substantial increase of energy prices**.
- Carbon taxes have been introduced in the UK, Denmark, the Netherlands, Germany, Italy, Slovenia, Sweden, Norway, and Finland.
- The introduction of carbon taxes has not always been successful.

Tradable Emissions permits

- Rights to discharge emissions that can be exchanged through a controlled permit-market
- Each permit represents a fixed quantity of allowed CO₂-emissions, typically 1 metric ton per permit (IEA, 2001). The number of permits in hands represents the total permitted emission quantity; a penalty is applied in case the actual emissions are in excess of this quantity.
- Permits could be allocated to companies on the basis of their historical output of emissions (grandfathering) or they could be auctioned.
- => flexible instruments
- => little experience
- => permits not only for CO₂, but also for NO_x and SO₂!

Subsidies

- The same environmental goal reached by taxing the most damaging fuels and technologies can be reached by subsidizing greener technologies and renewable energies. Since taxation on a EU level is very difficult to achieve, the Commission has opted to encourage the second solution.
- Subsidies range from tax credits given to companies that produce green electricity, or low-interest loans for the purchase of renewable energy equipment, to sales tax exemptions for the cost of renewable energy equipment.

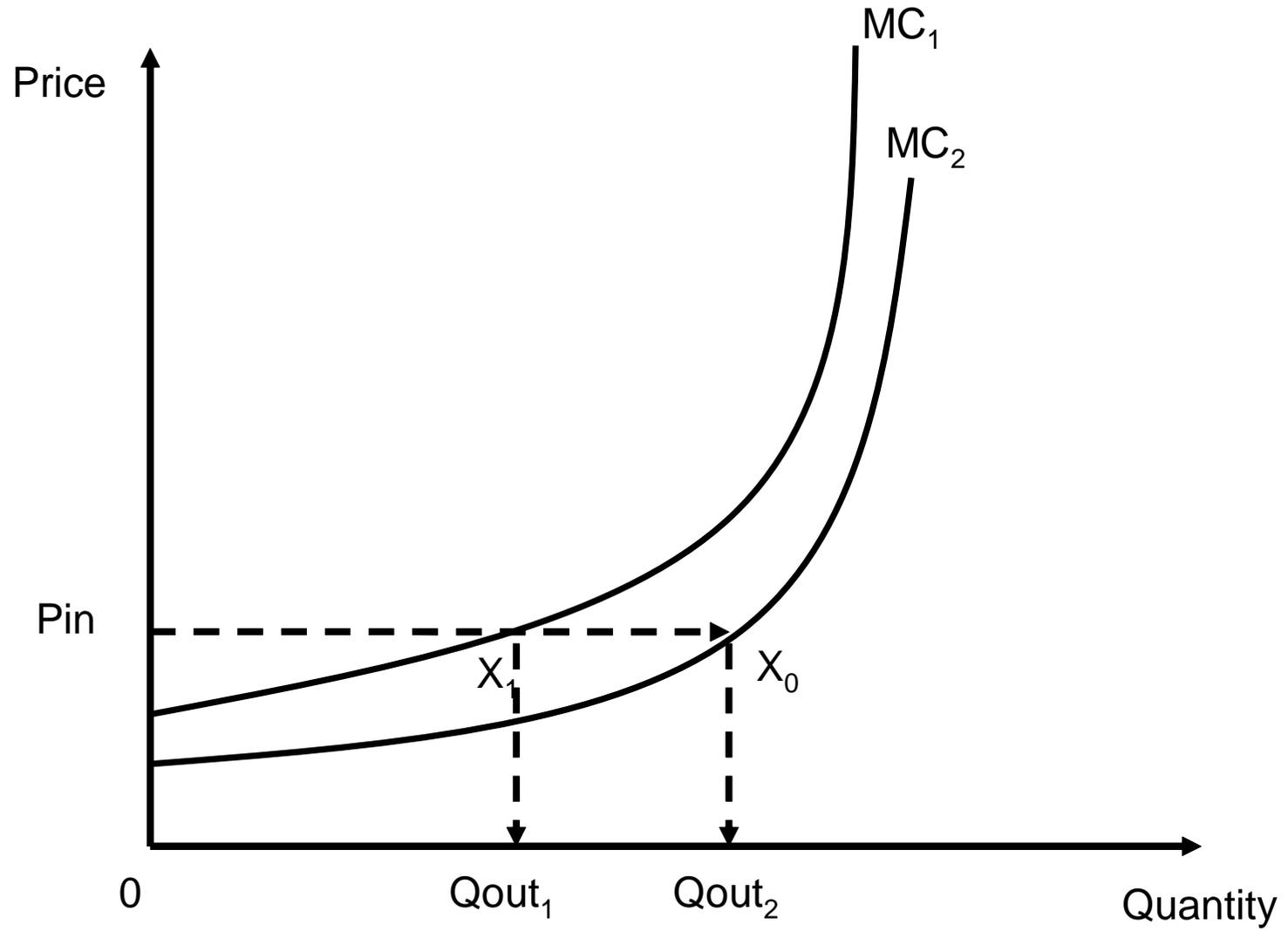
=> budget problem

=> will they be effective in stimulating renewables and limiting most damaging fuels?

Subsidies: Feed-in tariffs

- Obligation on the part of electric utilities to purchase the electricity produced by renewable energy producers in their service area **at a tariff determined** by the public authorities and guaranteed for a specified period of time (generally about 15 years).
- Producers of green electricity are encouraged to exploit all available generating sites until the marginal cost of producing green electricity equalises the proposed feed-in tariff price.
- Price instrument

Feed-in tariffs



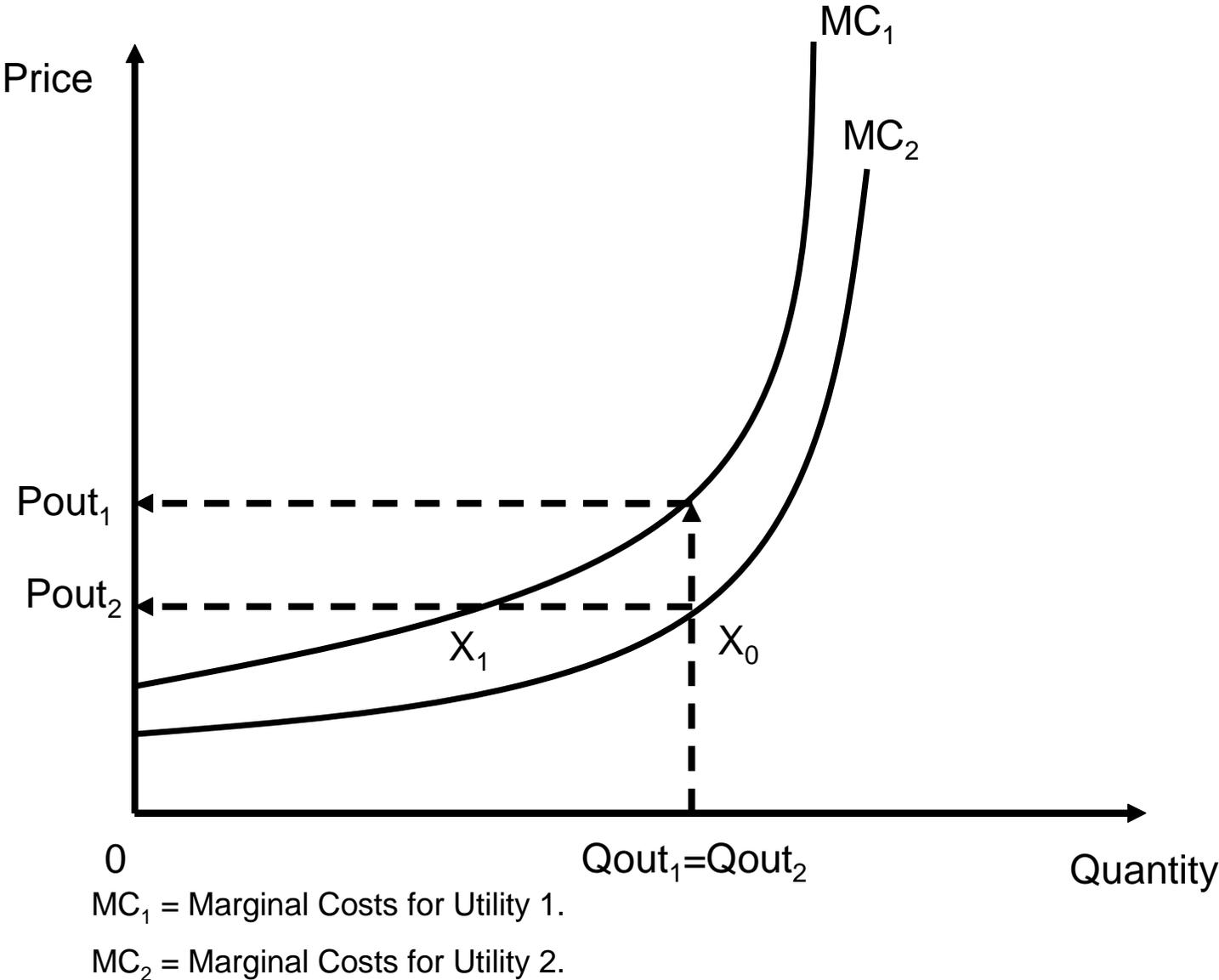
MC_1 = Marginal Costs for Utility 1.

MC_2 = Marginal Costs for Utility 2.

Subsidies: Competitive bidding processes

- The regulator defines a reserved market for a given amount of renewable energy and organises a competition between renewable producers to allocate this amount. Electric utilities are then obliged to purchase the electricity from the selected power producers.
- Competition focuses on the price per kWh proposed during the bidding process. Proposals are classified in increasing order of cost until the amount to be contracted is reached. Each of the renewable energy generators selected is awarded a long term contract to supply electricity at the pay-as-bid price. The implicit subsidies attributed to each generator correspond to the difference between the bid price and the wholesale market price.
- Quantity instrument

Competitive bidding system



Subsidies: Green renewable certificates (Renewable portfolio standards)

- The regulator imposes a quota as a percentage of the total electricity production, which has to come from renewable sources.
- Wholesalers, distributors or retailers of electricity are liable to respect the quota.
- To give them more flexibility and compensate for missing green kWh, they can purchase green certificates from the green electricity producers.
- The price of green certificates will be close to the difference in price between renewable electricity and classical electricity. The additional revenues for the producers will compensate them for this difference in price.
- Distributors, which do not achieve the quota imposed by the regulator, will have to pay penalties.

Green renewable certificates cont.

=> The start up of the green certificate market is difficult in countries with small initial renewable capacities.

=> although the renewable quota is respected, or even exceeded, the emission-reduction objective might not be achieved. Renewable electricity could be used mainly to compensate the increase in demand and not to substitute “dirtier” emission sources. However, this is an issue that would remain with any similar subsidy or with a carbon tax.

Voluntary Agreements (VA)

- VA are commitments by the industry to decrease the level of emissions in exchange, for example, of a training programme for energy-efficient purchasing and an audit provided by the authority.
- VA are the results of co-operation and negotiation between an authority and an industry and are intended to be followed by some form of contract.
 - =>VA do not result in significant effects on the environment.
 - => VA may hide a low ambition of the objective itself
 - => VA only contain a pollution program which follows a natural trend, a business as usual trend.

Voluntary Agreements Cont.

=> once an agreement has been signed, the initial pressure may dissipate and firms may have the opportunity not to comply with their commitments. Even though VA have been initiated in association with a regulatory threat, most have not included a monitoring and sanction for non-compliance mechanisms.

=> VA are often suspected to promote collusive practices between participating firms. The potential danger of industry collusion is greater when the voluntary approach concerns a contracted sector where a relatively small number of firms dominates the market

=> VA can never replace legislated regulations or other more conventional policy instruments.

Voluntary Measures: green electricity purchasers

- The diffusion of renewable energies cannot be assured spontaneously by the market, unless it is cost effective.
- But there is now some evidence that certain groups may buy some goods that are more expensive, because they have some public good benefits.
- The arrangements under a liberalised electricity market which enables consumers who want to pay for this environmental good to purchase green electricity directly from a supplier, is one response to this demand. This solution can provide insight into the preferences of consumers and their willingness to pay for renewables.

Experience with green electricity purchasers

- The problem of free-riding remains a very real one.
- The proportion of green electricity purchasers is low, around 2–3%, except with incentives in the form of tax exemptions for electricity consumers.
- In the Netherlands in 2001, 8% of consumers opted to buy green electricity, but with a tax incentive of 0.06 euros/kWh.
- This percentage may be increased by information campaigns, education, formation and training can help to increase the acceptance of renewable energies.

Generation disclosure rules

- “Disclosure” = the requirement that utilities provide their customers with additional information about the energy they are supplying (fuel mix percentages and emissions statistics.)
- “Certification” = the assessment of green power offerings to assure that they are indeed utilizing the type and amount of renewable energy as advertised.
- Both disclosure and certification are designed to help consumers make informed decisions about the energy and supplier they choose. Indeed, disclosure is often thought of as a good policy to help **educate customers** about electricity and thereby to prepare markets in advance of retail competition.

Criteria for choosing the policy instruments

- Efficiency
- Cost minimization
- Equity
- Technological innovation
- Energy security
- Feasibility
- Impact on the job market
- Uncertainty
- Site location

Efficiency

- Economic instruments, such as subsidies (tradable green certificates, feed-in tariffs, competitive bidding designs), taxes, emission permits should guarantee the best outcome in terms of efficiency and flexibility.
- Among subsidies, tradable green certificates seem to be the most appropriate (Menanteau et al., 2003)
- The efficiency of voluntary agreements is questionable: it depends on the agreement

Cost minimization

- Command and control impose costs of monitoring and enforcing
- Tradable green certificates and emission permits require a minimum of state involvement for the setup of the market
- Feed-in tariffs and competitive bidding processes do entail subsidies which can have a fiscal and welfare cost of their own
- Voluntary agreements are time consuming

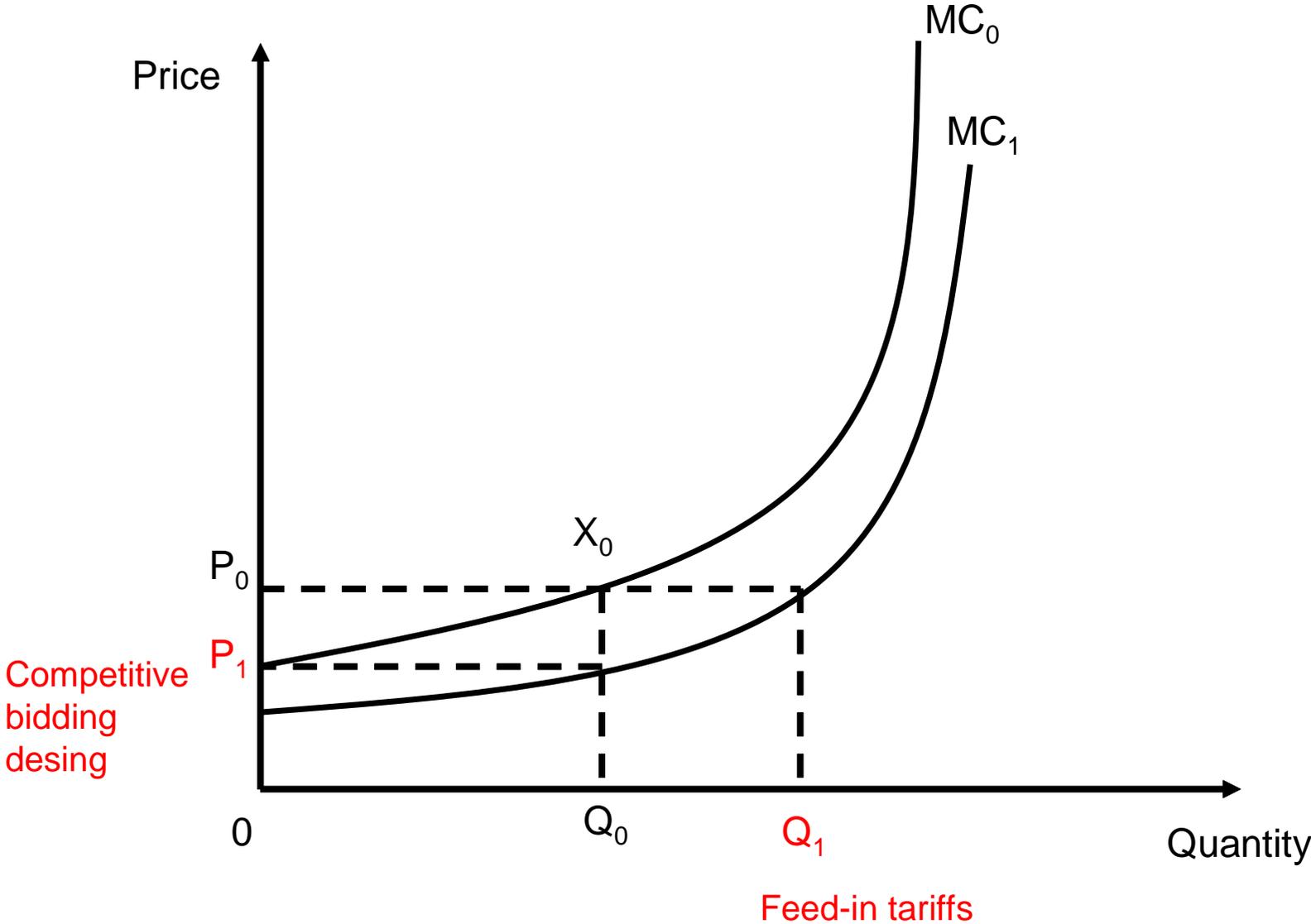
Equity

- Polluter pays principle, but who is the polluter?
- Increase in electricity prices that consumers pay, independently on their income?
- Political decision

Technological innovation

- The optimal instrument(s) should remove imperfections in the systems of innovations
- Economic instruments should generate a dynamically efficient pattern of incentives on corporate and consumer behaviour
- The effect on prices and quantities are different according to the type of instrument => implications for energy security
- Feed-in tariffs have proven to be quite successful in Germany
- Some researchers consider command and control instruments in a rather positive way: if the regulator is able to identify a best-practice environmentally friendly technology

The effect of a technological change on quantity and price of green electricity production



Energy security

- Policy makers should also consider how instruments affect the security of energy supply and how the liberalization of markets will influence the applicability of each instrument.
- These concerns should especially take into consideration the rising level the demand for energy.
- This means that it might be important to focus more on instruments that can stimulate the increase in the production of green electricity, rather than instruments that affect the price of green electricity.
- In terms of overall dependence on foreign supplies of fossil fuels, the move to renewable sources has a positive impact (i.e. it reduced dependence). In terms of overall reliability of supply of the electricity system, however, the position may be more complex and more work is needed on that.

Conclusions

- Several instruments are available
- Subsidies seem an appropriate set of instruments, however...
 - Budget constraint
 - Equity issues
 - What about countries with a low renewables potential?
- Further work is needed in the identification of optimal instrument(s)