Support Mechanisms for Sustainable Power

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Issued to be covered

This presentation will detail:

- the main mechanisms
- feed in tariff in Germany (Denmark)
- obligation in the UK (Italy)
- the feed-in versus obligation debate
- elements of design and policies

Why do renewable technologies need support?

- Developing technologies ➔ R&D
- Perceived investment risks ➔ Public intervention
- New technologies are not at all on a level playing field with conventional ones:
  - Negative externalities (pollution) of conventional energies versus system benefits of new technologies
  - System costs of clean technologies are higher versus subsidies are going to conventional energies

Unfair treatment of RE

Subsidies to fossil-fuel energy were on the order of $250 billion per year*?

versus

sales of "new" renewable energies are on the order of $20 billion per year

World Bank, 1992. OECD, 1992

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What is a feed-in tariffs?

- Minimum (specified) guaranteed price for output or a premium on market prices for electricity
- Paid by electricity utilities to the producer
- Level of the tariff often set for a number of years
- Tariff can be based on the avoided cost to the utility, the end price to the consumer, or set at a level intended to stimulate renewable deployment

Feed-in tariff issues

- E.g. Germany
- Issues:
  - Costs to consumers
  - Long-term political commitment due to perceived high costs
  - Possible windfall profit – risk of over-funding
- Can be managed by:
  - Declining premiums
  - Flexibility of the tariff (revision)

What is a quota systems?

- Obligation for a certain quantity of renewable production or consumption
- Projects selected by utilities who have an obligation rather than government
- Emphasis on cost, though the schemes may be banded to encourage developing or more risky technologies
- Penalties for non-compliance
- Often supported by tradable green certificates

Quota systems

- E.g. UK Renewables Obligation
- Issues:
  - Emphasis on the cheapest technologies, rather than developing new technologies
  - Participation can be relatively costly – favours large companies with a diverse portfolio, rather than new entrants
  - Investor uncertainty (short term contracts)
- Addressed by:
  - Banding
  - Allow consolidation of services for small developers

What is a tender system?

- Competitive bids for individual projects
- Government sets desired limits for different technologies, length of contract and selects winning contracts
- Criteria can include:
  - Costs
  - Technical quality
  - Socio-economic and environmental factors
- Obligation on suppliers to buy a certain amount of renewable power at a premium price – price difference financed through a levy on consumers

Tenders

- E.g. Ireland
- Issues
  - Stop/start nature of contract processes
  - Bureaucracy
- Can be addressed by:
  - Rolling contract periods
  - Review of contract award processes

Synthesis main RE mechanisms

Feed-in laws: price fixed,
quantity determined by the market

Quota obligation/tender: quantities fixed,
price determined by the market

	Price	Quantity
Feed-in law	Law	Market
Quota/Tender	Market	Law

EU country studies

- Feed-in tariff
  - **Germany** **“pure” feed-in**
  - Denmark
  - + Spain,…
- Obligation certificates
  - **UK** **ROC**
  - Italy,
  - + Sweden, Belgium, Poland

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Level of feed-in tariffs in Germany

	2005 (Cent/kWh)	Degression* (%/a)
Hydropower	6.65-9.67	0
Biomass (<20MW)	8.27-17.33	1.5
Geothermal energy (<20MW)	7.16-15.00	1.0
Wind energy (onshore)	5.39-8.53	2.0
Wind energy (offshore)	6.19-9.10	2.0
Solar energy	43.42-59.53	5.0

* Tariff for an installation depends on the year of the initial operation

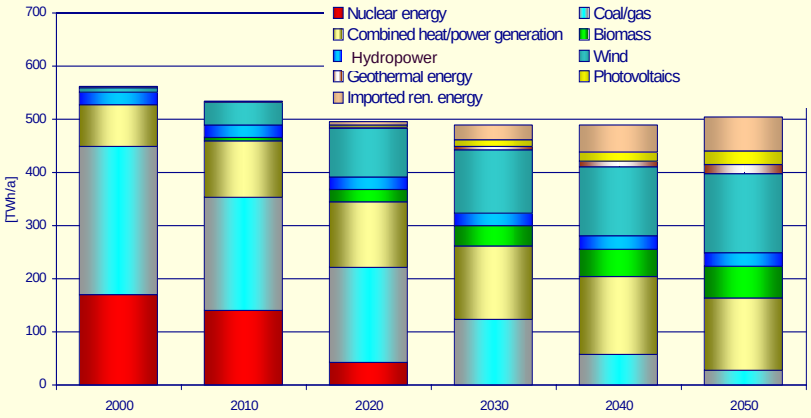
Differentiated tariffs

- All types of RE are needed to reach the RE targets
- Costs for RE electricity depend on different factors,
  e.g. kind of RE or size of plant
- Consequences:
  - → tariffs need to be differentiated by source and size of plant
  - → tariffs for new plants need to decrease every year to further technological development and to bring costs down
- Calculation:
  - Scientific studies investigate specific cost per kWh.
  - Payback period: 16 to 20 years
  - Internal rate of return: e.g. wind power: ~10%

Ambitious targets

- Targets for the share of RE electricity:
  - 2010: > 12.5 %
  - 2020: > 20 %
  - 2050: ~ 70% !
- Ambition: to get rid of the nuclear energy
  - Chernobyl in 1986

Electricity Scenario up to 2050



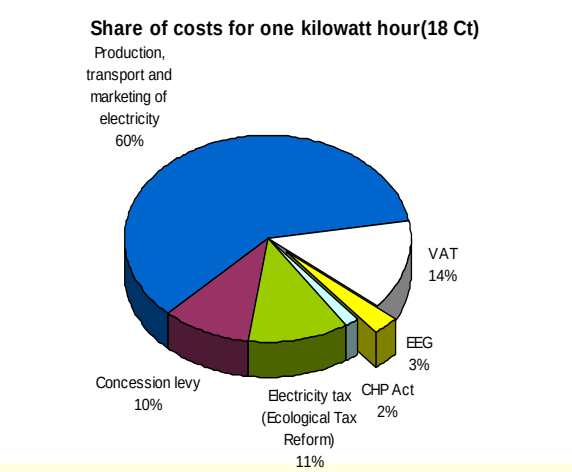
Quelle: Fischedick, Nitsch u.a

Achievements of the laws (2005)

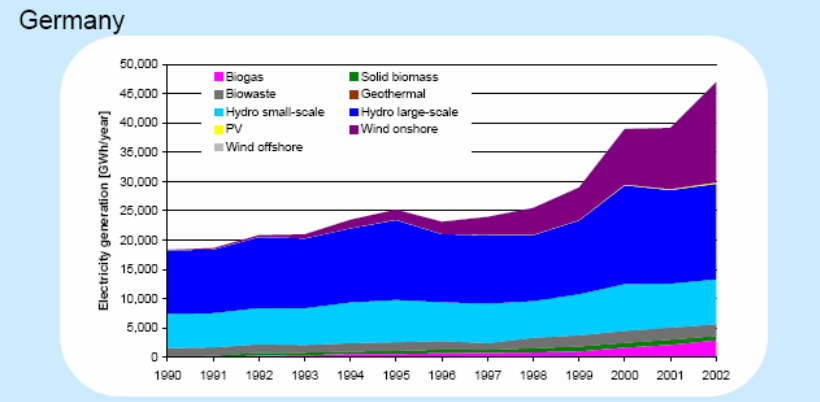
- Rapid growth of RE (about 10 % per year since 1999)
- Share of RE electricity about 11% by the end of 2005 [1999: 4.6 %]
- 150,000 jobs
- 11.5 billion euros turnover per year
- 6 billion euros investment per year
- 52 million tonnes of CO_2 reduction

- …for 3% of the cost of the generation of a KWh

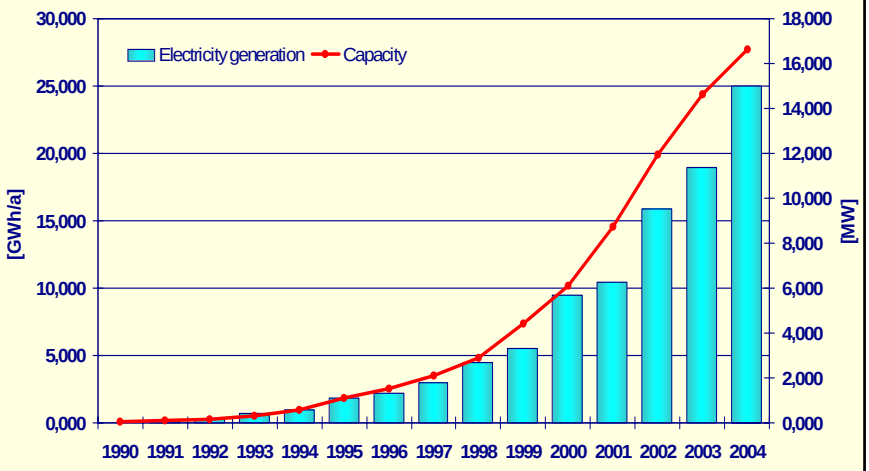
Cost for the promotion of RE just 3%



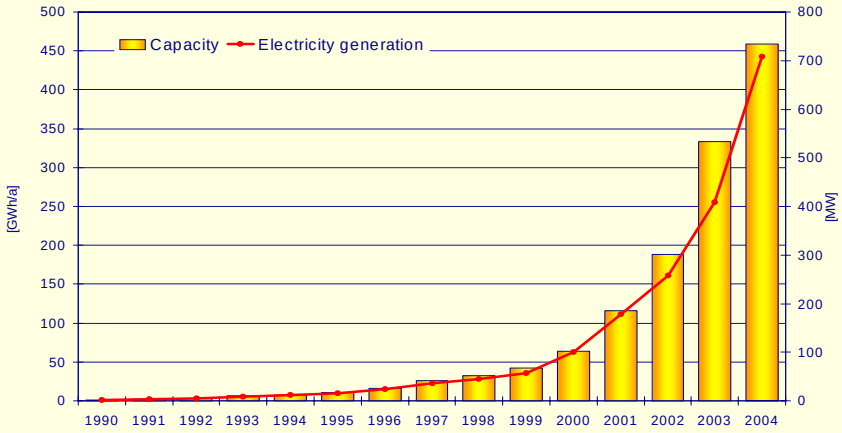
Growth of RE in Germany



Wind Energy in Germany



Photovoltaics in Germany



Future of feed-in in Germany

- Important success
  - Long existence (+ 15 years)
  - Strong political commitment (Green Party)
- No reason to change
  - Domestic reasons
    - Consensus about climate change
    - Creates jobs (trade-unions)
  - International image of Germany

Feed-in in Denmark

- Also a “success story” in terms of RES-E, mainly with wind-power
- Combination of several factors
  - research
  - certification process (sub-standard product)
  - feed-in
- The majority of Danish turbine are owned by private households based on neighbourhood cooperatives = 150,000 shareholders
- Return on investments 10-15% (after tax)

Feed-in in Denmark and windpower

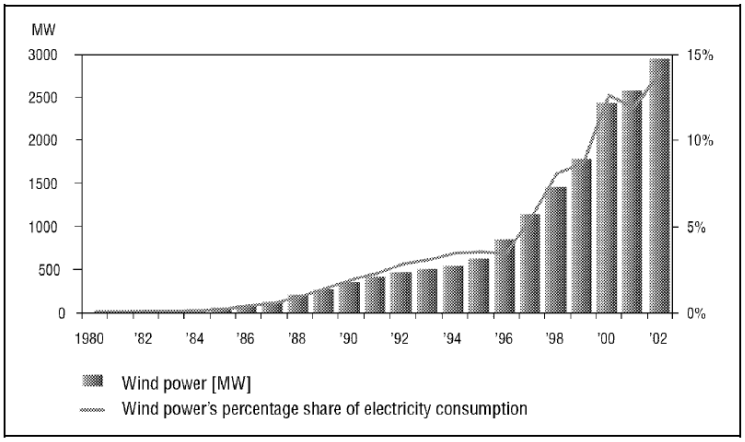


Figure 1. Development of installed Danish wind capacity from 1980 to 2002 [DEA]

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Renewable Obligation

- Quota systems = suppliers have to buy a certain percentage of RE

+

- Suppliers use certificates that come from RE generation to prove they meet their obligation

= flexibility by dissociation with physical flux of electricity

- Introduced in 2002 till 2027

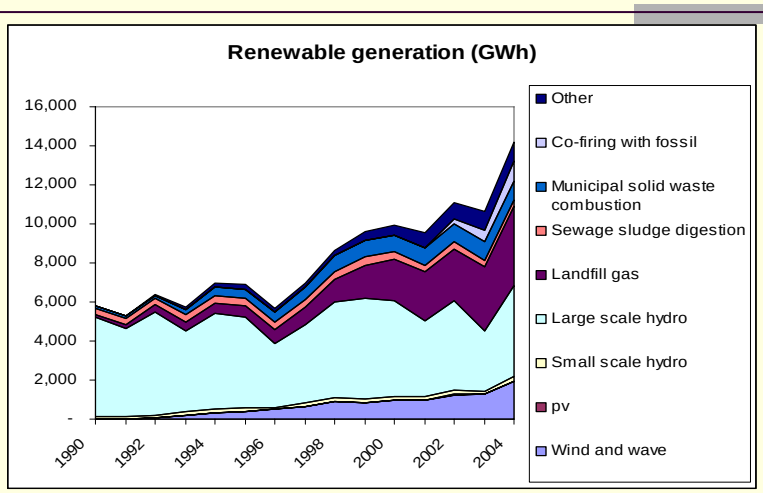
The RO – how it works

- An obligation is placed on a supplier to meet a certain percentage of the previous year's supply from eligible renewable electricity
  - Proven to Ofgem by ROCs (1 ROC = 1 MWh)
  - Ofgem operates an electronic registry
- The supplier can either meet the obligation by purchasing/producing ROCs or by paying a penalty, which is recycled back to the suppliers in the proportion that they met the total annual RO target
- Suppliers and renewable generators agree price, contract length, volume.
- Renewable electricity only has value up to the annual obligation percentage

Analysis of RO

- Fits well with liberalised market
- Risky mechanism
  - Price unknown?
  - Volume unknown?
- Good for incumbents BUT not good for new entrants
  - need to be suppliers and be able to take risk
  - not set up to do better than obligation
  - only good for cheapest market technologies

Renewable Generation in the UK



RO analysis: strategy of actors

Different strategy among supply companies

- Big companies tend to meet their obligation
- Small companies tend to pay penalty (half of them)
  - The main problem is not the current price, but short – term contracts… too short for developers who cannot raise money
    - Even if some long-term contract, but only 5, rarely 10 years (with ROC at a low price)
  - The other issue for small companies is the one of high transaction costs

Results so far

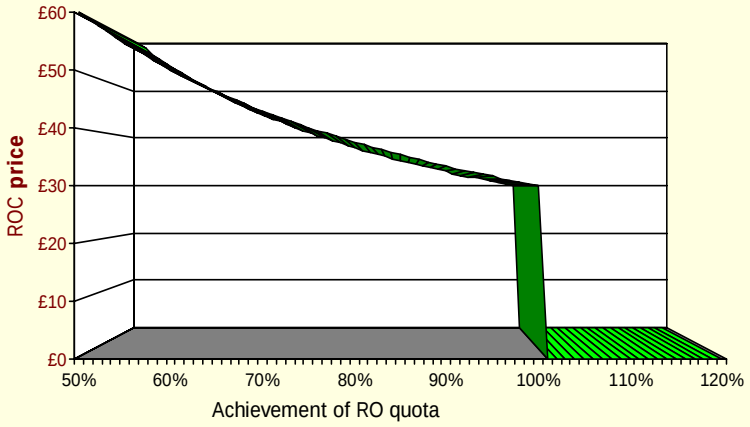
	Target	Achieved*	%
2002-3	3.0	1.8	60
2003-4	4.3	2.4	56
2004-5	4.9	3.4	69

* includes large hydro and renewables already in place.

RO analysis: ROC prices

- The system works only if the ROC prices remain at a high level
  - => obligation target >> than RES generation
- Initially
  - 3% in 2002 to 10,4% in 2010
  - and remain at 10,4% till 2027
- Finally target 15,4% by 2015

RO Risk



Design of quota/certificate

Two way the market of certificates can work:

- Market driven (e.g. UK)
  - Target Obligation >> capacity in RES
  - Price of certificates high = incentives to build capacity
  - BUT penalty not too high
- Regulated (e.g. Italy)
  - Obligation can be met
  - Prices of certificates low
  - BUT penalty is high = incentives to build capacity

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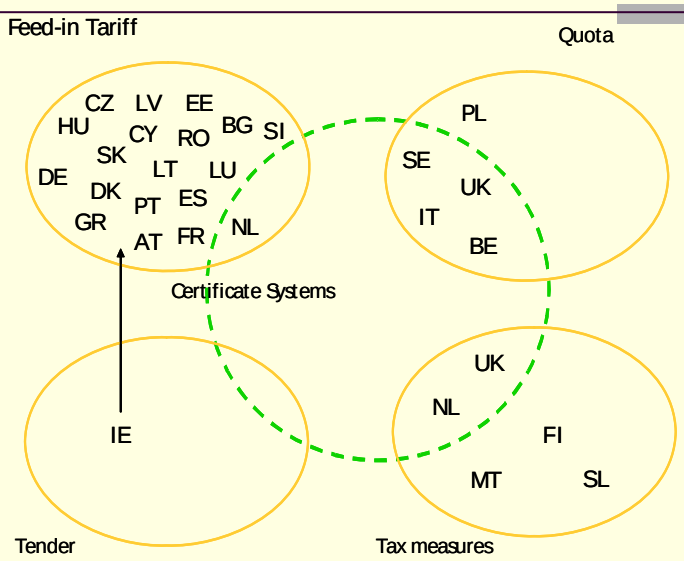
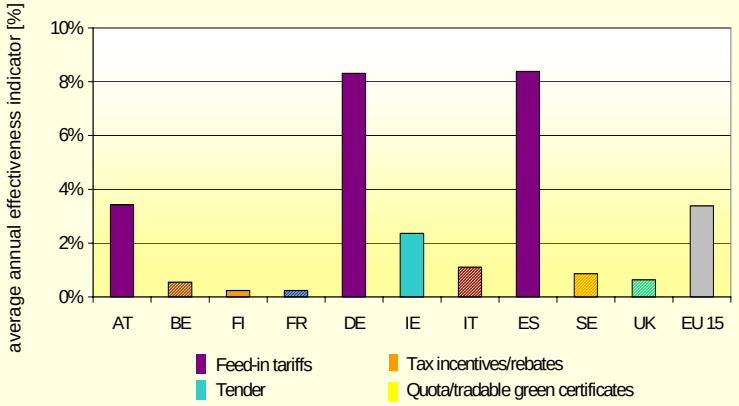
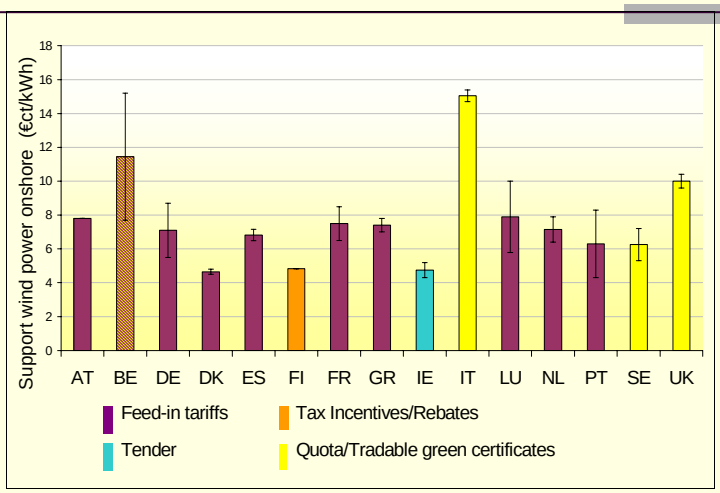
Main policies renewable electricity support EU



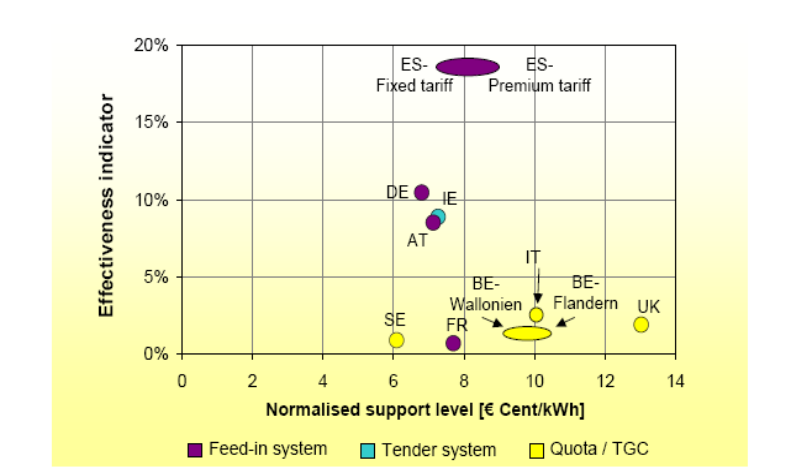
Achievements in the sector wind on-shore - period 1997-2004



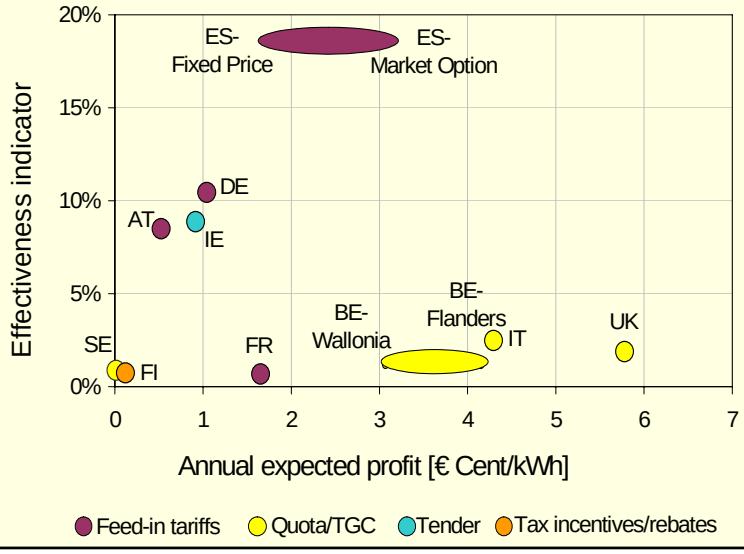
Level of financial support for wind on-shore EU-15 in 2004



Effectiveness/support level wind on-shore 2004



Effectiveness vs. profit for wind on-shore in 2004



Conclusions from the example of wind energy

Comparison of the current level of support and the effectiveness:

- Countries with quota/certificates systems as the main support instrument (Italy, UK and Belgium) show high expected annuity of support at low growth rates
  + can lead to high producer profits resulting from high investment risks
- Countries supporting wind energy based on feed-in-tariffs (Germany, Denmark) tend to be more effective at generally moderate levels of support

Conclusions on effectiveness of RES-E support (1)

- Effectiveness of the promotion of **innovative technologies** like wind energy, agricultural biogas and photovoltaics has been the highest in countries with **feed-in tariffs**
- Effectiveness of the promotion of **low cost options** like sewage gas and certain fractions of agricultural biomass has been high in countries with non-technology specific RES-E promotion schemes like tax incentives and **quota obligations** based on Green certificates

Conclusions on effectiveness of RES-E support (2)

- Limited effectiveness of theoretically powerful instruments is experienced in a number of markets:
  - In **feed-in systems** typically due to high **administrative and grid barriers**, e.g. in France
  - In **quota systems** typically due to **low penalty** or **high risk level**
  - **only selected technologies** are supported **in some markets**, e.g. in Finland (tax measure) and in most quota systems

Generally the effectiveness also depends on country specific traditions and conditions (apart from potentials and policies).

Conclusions on effectiveness of RES-E support (3)

- Main success factor: **stable support systems** and **low overall barriers** (e.g. Germany)
  - the long-term institutional commitment that provides investors
  - the administrative simplicity of the procedures to reduce delays for investors
- Otherwise even high level of financial support does not guarantee success because perceived risk (e.g. Portugal, Belgium)

Conclusions only provisional…

- **Feed-in**
  - **Simplicity**
  - **Cost-effectiveness**
  - **20 years of experience**
- **Quota**
  - **Complexity – high administrative costs**
  - **Only effective for low-cost technologies?**
  - **Initial stage of development**
- **Mechanisms are just a part of an integrated energy policy**
  - **Administrative barriers (territorial planning, grid connection rules)**

➔ Comparative analysis to be completed…

Dissemination of the two mechanisms

- Feed-in mechanisms
  - **One system in Europe (Germany, Denmark…)**
  - **Main system in the world**
    - **+ 30 countries in the world have a feed-in tariff**
    - **India, China, Indonesia, Brazil, Nicaragua, Costa Rica, Sri Lanka, Thailand, Turkey, … + South Africa?**
- Obligation mechanisms = quota
  - **Renewable Portfolio Standard – RPS (USA)**
  - **Renewable Obligation (UK)**
  - **+ Sweden, Italy, Belgium, Poland (Europe)**
  - **Mandatory Renewable Energy Target (Australia)**
- Old debate feed-in versus obligation?
  - **Just an element of a global policy**
  - **Design is more important than the tag**
  - **More and more mix of the two mechanisms (India)**

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Articulation with policy aims

- The mechanism has to be designed to address relevant policy aims
  - **Environmental** - **to reduce emissions of greenhouse gases or air pollution**
  - **Security** - **e.g. reducing imports, and increasing diversity**
  - **Universal supply** - **to increase access to electricity for the poorest in rural areas**
  - **Creating jobs and technical expertise** - **investment in RE creates 10*/100* more jobs than in conventional energies**
- And articulated with other policy measures
  - RD&D programmes
  - Investment support (capital grants, tax breaks)
  - Indirect measures – planning regulations, pollution regulations
  - Negotiated or voluntary agreements with system actors

Way forward – general design criteria

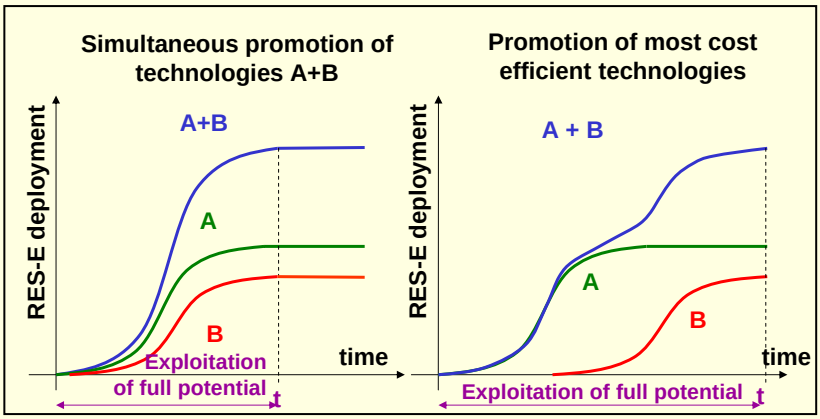
Ensure effectiveness,
reduce risks to investors,
minimize cost for consumers

- Set **long term, sufficiently ambitious** but realistic targets
  - Of particular importance in quota systems
- **Policy stability,** no stop and go policy!
- **Existing capacities** and **new capacities** should **not be mixed**
- **Duration** of support for new capacities should be restricted
- **Remove non-economic barriers**
  - Administrative, legal, grid,…
- **Compatibility with other policies**
  - Climate policy, agricultural policy, demand-side measures

Production of what and where?

- The global potential of each sector has to be estimated
  - The kind of (intermittent) production and its location have to be specified
    - Energy needs where and when
  - The impact of the realisation of this potential has also to be estimated
    - Employment
    - Number of companies
    - Reduction of cost – competitiveness
- The target has to be quantified in terms of percentage of realisation of this potential
  - Investment in capacity, production or consumption
- The main barriers for the realisation of this potential have to be understood
- Cost-effectiveness of alternative mechanisms have to be estimated

When?



In conclusion

- Sustainable energy technologies tend to be less developed than ‘conventional’ electricity generation technologies.
- The use of support mechanisms is a necessity to drive the new technologies towards commercial viability by encouraging deployment and reducing investor risk.
- The design of the mechanism has to be carefully done in connection with policy aims