Innovative Democracy and 100% Renewable Energy in 2050
- the Danish case

SMART *ENERGY SYSTEM* POLICIES

Reform Group Meeting, Salzburg 1-5 September

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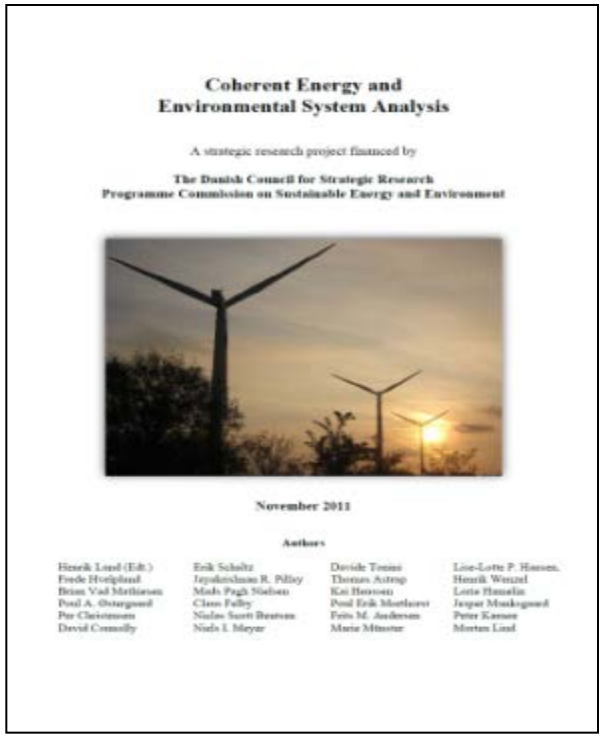
1. Technological change and the need for new ways of thinking Political Economics.

The 100% RE project- CEESA project

www.ceesa.plan.aau.dk



Coherent Energy and Environmental System Analysis

A strategic research project financed by

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Policies for a transition to 100% renewable energy systems in Denmark before 2050

Coherent Energy and Environmental System Analysis

Background Report Part 4

September 2012

A strategic research project financed by

Preconditions

1. We are dealing with a radical technological change
2. Which is a win-lose situation, and not the win/win whishfull thinking situation.
3. Renewable Energy (RE) is not any longer the ”Little innocent child” playing around in the corner. RE ”steals” large market shares. So we have reached a phase, where the economic conflict between nuclear/fossil fuel interests and RE is growing steeply. Fossil fuel companies are fighting back!
4. We are in an economic crisis that can be used against RE.
5. Fluctuating RE confronts the infrastructure wall. Bad handling of this, may result in expensive RE which can be used against RE. Consequently it is necessary to develop concrete institutional economics and better democratic procedures and ownership models. (Innovative democracy)

A dilemma/two scenarios

Scenario 1. Renewable energy systems are owned by large power companies. Without local ownership, cheap onshore solutions will be stopped, and expensive offshore wind power solutions will be the result.

This results in political resistance that might stop RE development.

Scenario 2. Renewable energy systems will be owned by local and regional organisations. This makes relatively cheap onshore and smart energy systems possible. This model will meet heavy resistance from existing power companies, which will try to make politicians ”give” the ownership of RE to these companies.

So the dilemma is: Either corporate RE ownership, expensive RE and stagnation, or local and regional RE ownership, cheaper RE and RE expansion.

(In Denmark the costs of CO2 abatement in the present market construction is around 10-15 Euro per ton for onshore- and 33-60 Euro per ton for offshore wind power.)

Dr Jekyll / Mr Hyde economics

a. Neoclassical economics

(free society/free market/Dr. Jekyll)

+

b. Black institutional economics

(reality/oligopoly/lobbyism power Mr Hyde)

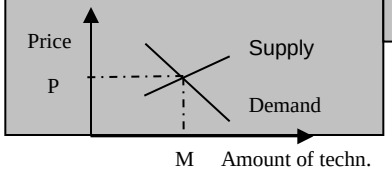
=

Dr Jekyll/ Mr Hyde economics

Neoclassical Economy/Dr Jekyll

3. "Direct" market policy (CO2 quotas, Carbon trade etc.)

2. Existing market conditions and technology choice



1.Goals of society

- **Growth**
- **Competitiveness**
- **Employment**
- **Climate**
- **Democracy**
- **Etc.**

The assumed free market institutions/"rules of the game" (Dr Jekyll)

4."Free market" institutions

- **Many mutually independent sellers**
- **Many mutually independent buyers**
- **Full information**
- **Rationel consumers.**
- **-- etc.**

Note: This type of understanding is embedded in (almost) all econometric models in the Ministries of Finance all over the world

5. P a r l i a m e n t

Mr Hyde concrete institutional economy

"Direct" market policy (CO2 quotas, Carbon trade etc.) Mr Hyde

"Indirect" market policy "RE certificate trading", corporate ownership, etc. **Mr Hyde**

Technical scenarios/present marketconditions

Changing Institutional market design

- **Tax structure**
- **--Tarif structure**
- **-Schools/Universities**
- **-Technological Institutions.**
- **-Corporate ownership.**
- **-Etc.**

Goals of society
- **-Climate**
- **-Energy independence**
- **-Economy**
- **-Democracy**
- **-Employment**
- **-Innovation**
- **-Etc.**

P a r l i a m e n t - M u n i c i p a l i t i e s

Old "energy market dependent" lobbyists
- **-Large oil-/coal- uranium mining companies**
- **-Large power companies.**
- **-Etc. Mr Hyde**

Be aware: The "visious" element linked to Mr. Hyde here connotes to the the search of mainly short term organisational "sector self-interest". So we are not talking about good or bad people, but about an institutional construction and institutional inertia of sectoral self-interest. A mechanism which is tried hidden behind the Dr Jekyll "free society" "free market" vocabulary of neoclassical economy.

The change from fossil-to Renewable Energy, or the case for ”Innovative democracy”-

we are dealing with -

1. Politically weak renewable energy- and energy conservation technologies that must gain massive market shares.

2. Politically strong coal, oil, gas and uranium based power companies that must and also do lose massive market shares.

3. This gives an increasing conflict between strong fossil fuel interests - and Renewable Energy and energy conservation technologies/interests.

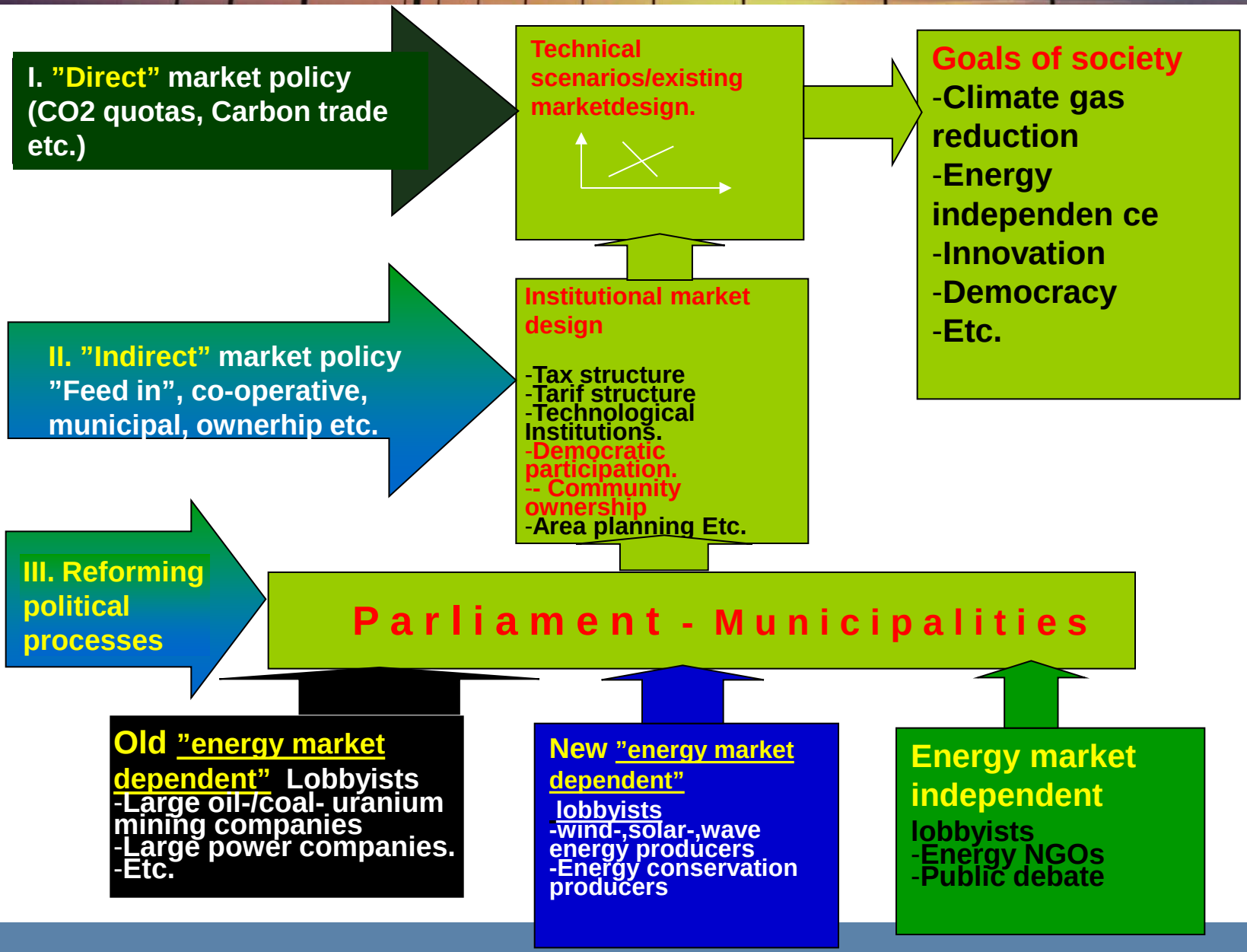
4. This is not just a nice ecological modernization game! And this conflict has come to a though phase in these years.

The political challenge is to make strong technologies lose turnover, and weak new technologies gain market shares.

This political challenge requires

”Innovative democracy”, or increased political strength to lobbyists that are independent of the fossil fuel interests.

Concrete institutional economy/*Innovative democracy*



The Innovative democracy/Institutional Economy- understanding

1. The market is a human made institutional construction. And different from country to country.

2. The economy therefore is not pr. definition in optimum.

3. Therefore there are “free meals” –it is possible to find better economic situations than the present. (onshore instead of offshore wind, local ownership of wind turbines, no fixed tariffs, etc.

4. The political process should include influence by both economic dependent and economically independent lobbyists.

This understanding is also the base for a new type of innovative feasibility studies. And only this approach makes it possible to establish a change in energy policy towards 100% renewable energy and conservation.

2. A 100 % Renewable Energy scenario

www.ceesa.plan.aau.dk

Innovative Democracy and scenarios
(both technical and institutional)

1.Technical scenarios

-Fokus on the free development of alternative scenarios

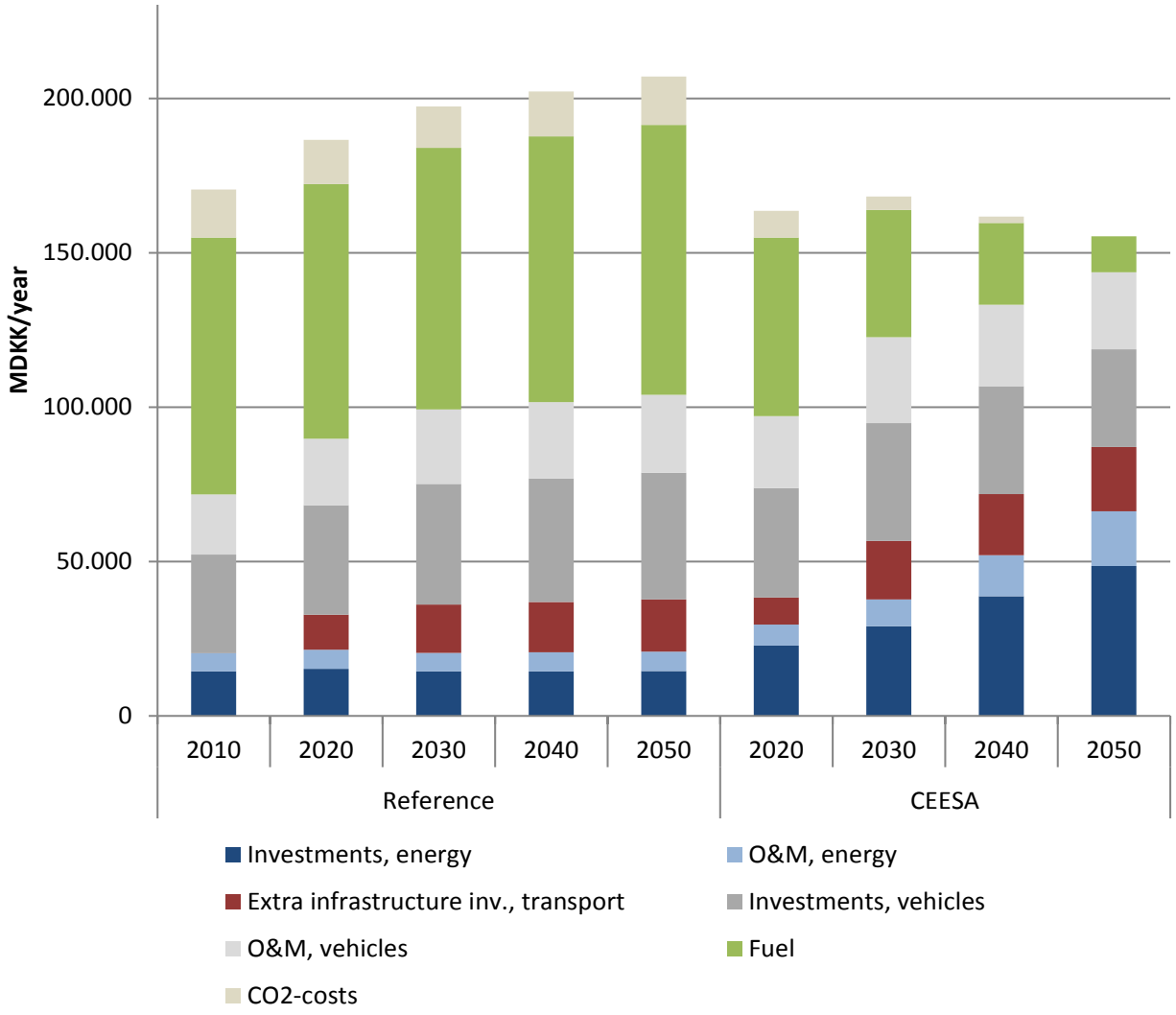
- Select the best one.

2. Institutional analysis - find out what hinders the implementation of the best scenario.

3. Policy scenarios. Design concrete institutional scenarios that makes ”the best” technical scenario happen. Makes us able to ”turn”.

Scenarios based on neoclassical and institutional economic theory would have less alternatives and not include 2 and 3 !!

Socio-economic costs in CEESA



- Total energy system and transport system costs could be 20B€
- Transport pose a very high portion of the costs compared to other energy services
- Direct economic advantages in transition
- In addition:
  - More stable costs
  - More jobs
  - More export
  - Lower health costs

Cheaper than the fossil fuel alternative amongst other because:

1. Supply and demand side are synchronised.

2. The needed fluctuation/intermittency infrastructure for Renewable Energy is established.

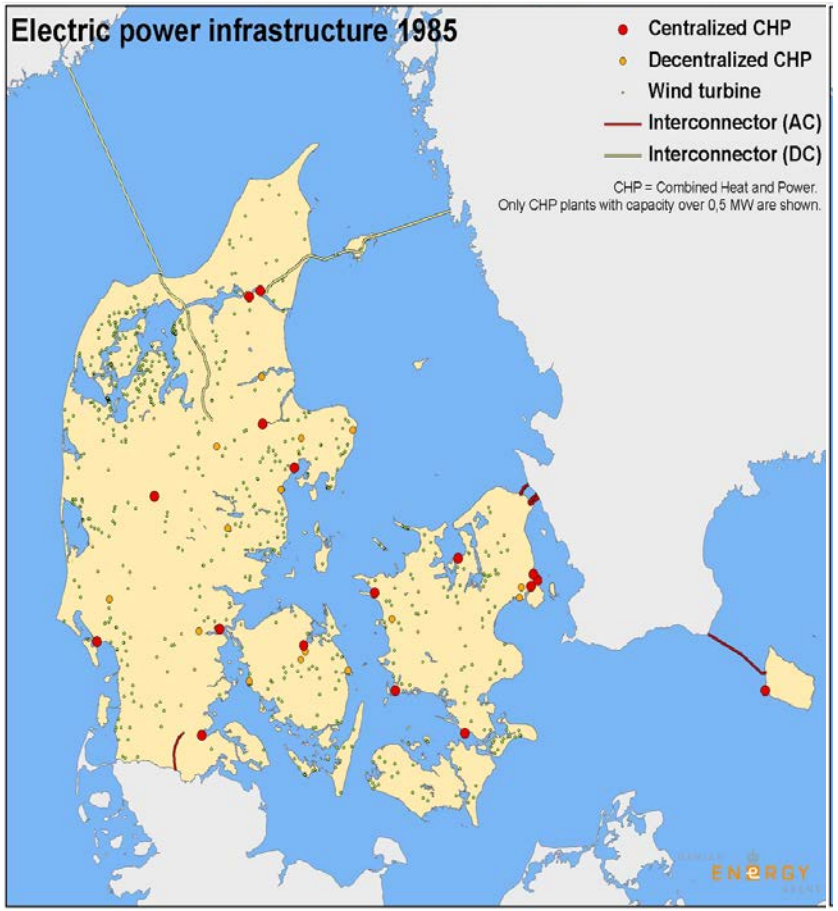
3. Danish Energy Policy

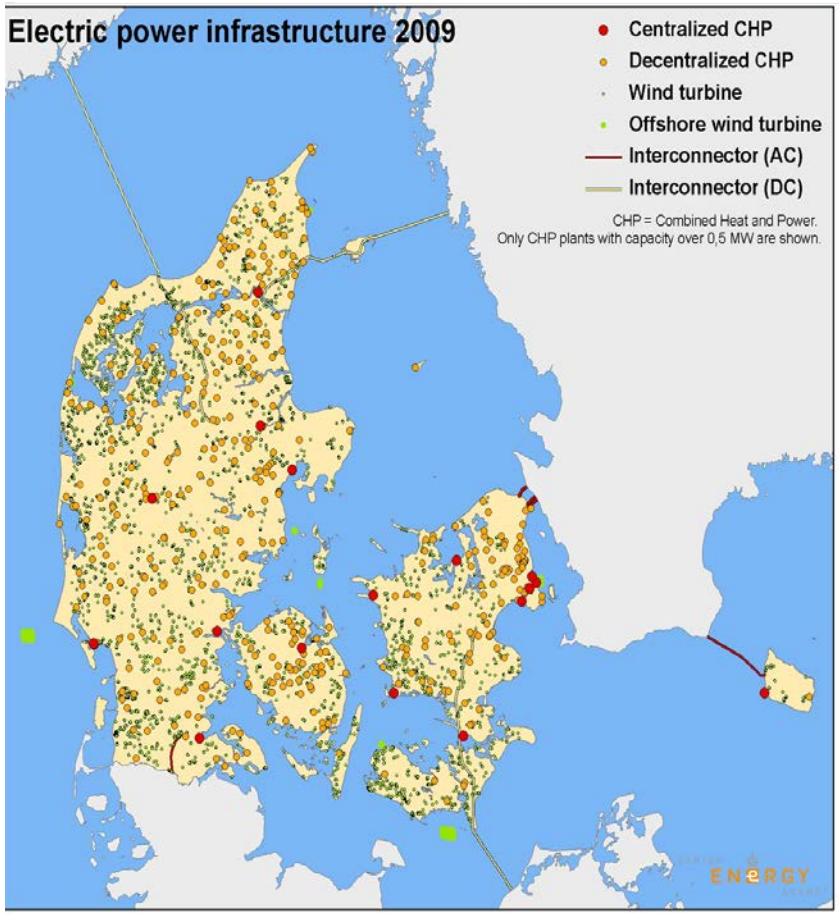
New Government September 2011

- 100% RES by 2050
- 100% RES for electricity and heating by 2035
- No coal on power plants and no oil for heating households by 2030
- 50% wind in electricity supply by 2020
- 40% CO2 reduction by 2020 compared to 1990

4. The smart energy system

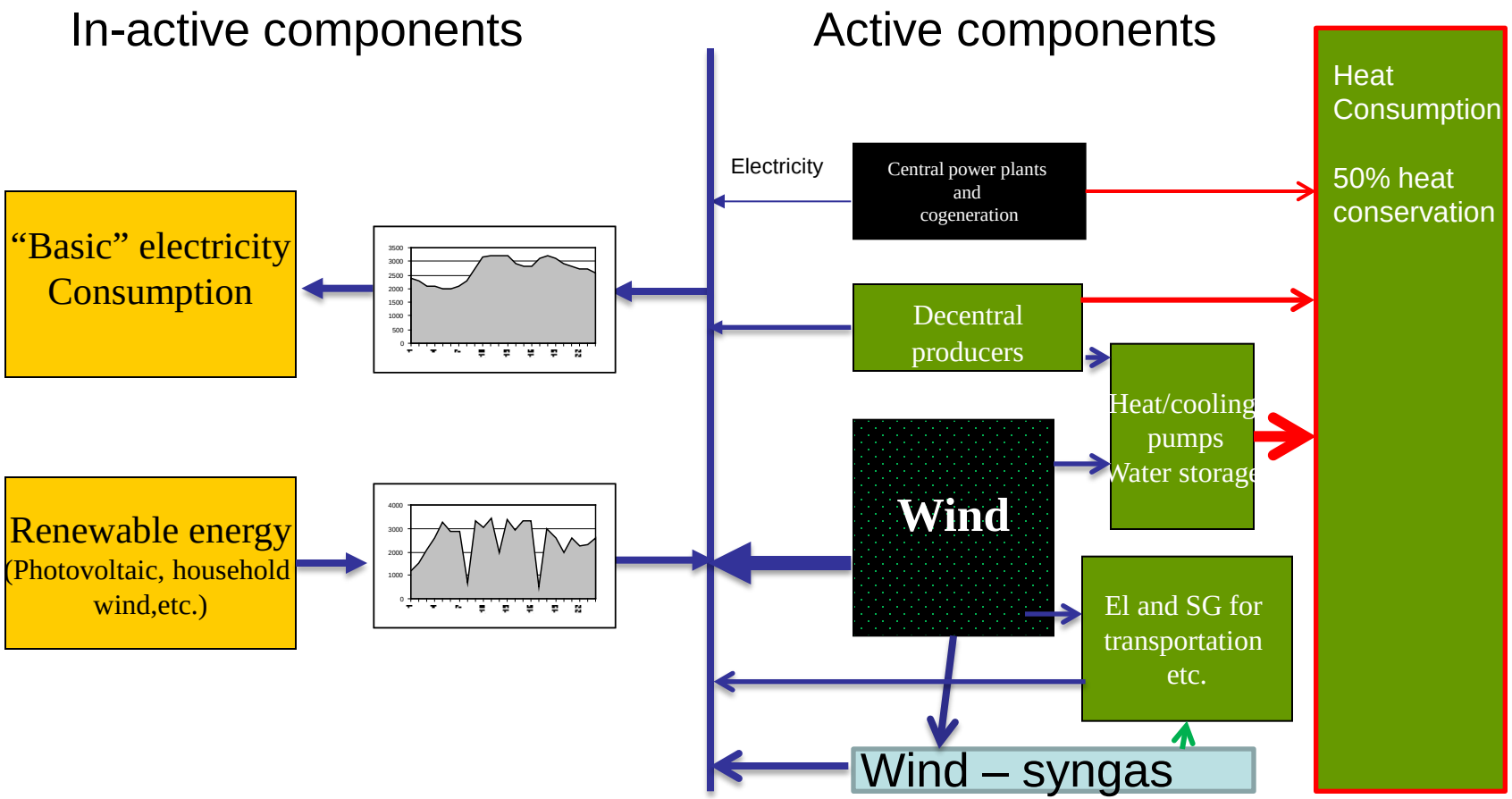
Transition from a hierarchal centralised to a semi-decentralised energy system – Status





System 4 (2015- 2050 wind power 50%-100%)

Activating RE via increased electricity consumption for heat pumps and transportation, electricity and heat conservation.



5. Is the transition too expensive on a short term base?

Expected Public Service Obligation (PSO) costs in 2020 (Present wind-power policy)

	Offshore	**Near-shore**	**Onshore**	**Sum of all wind power projects**
Anholt (2012-2014)	400 MW			
New	1000 MW	500	1800 (net increase from today 500 MW)	
Production in MWh	5320000 (3800kWh/kW)	1650000 (3300 kWh/kW)	3900000 (2200 kWh/kW)	
PSO payment in euro per MWh	100	50	30	
Sum PSO payments in million euro/year	532	83	117	732 (Or around 2 eurocents per kWh. If electricity consumption is 35 Twh per year)

Table 2. *PSO costs linked to the present Danish wind power plans for 2020.*

Problem

With this program wind power may become politically too expensive, due to the large share of expensive offshore windpower.

And the Public Service Obligation (PSO) payment will increase from present 0,4 Eurocent per kWh to at least 2 Eurocent per kWh electricity consumption in 2020.

Industrial Electricity prices in Eurpope, first half 2013.

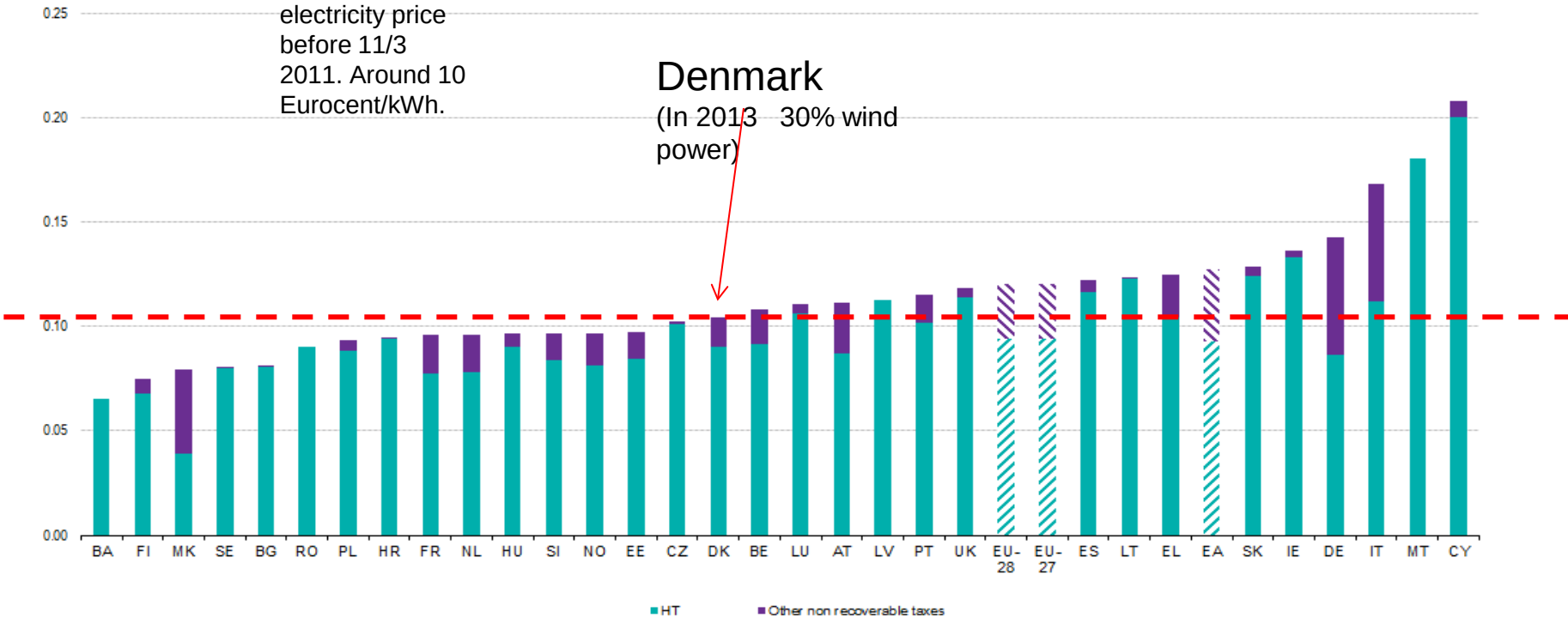
http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Energy_price_statistics

Prices excluding VAT for consumers between 500 MWh/year and 2000 MWh/year.

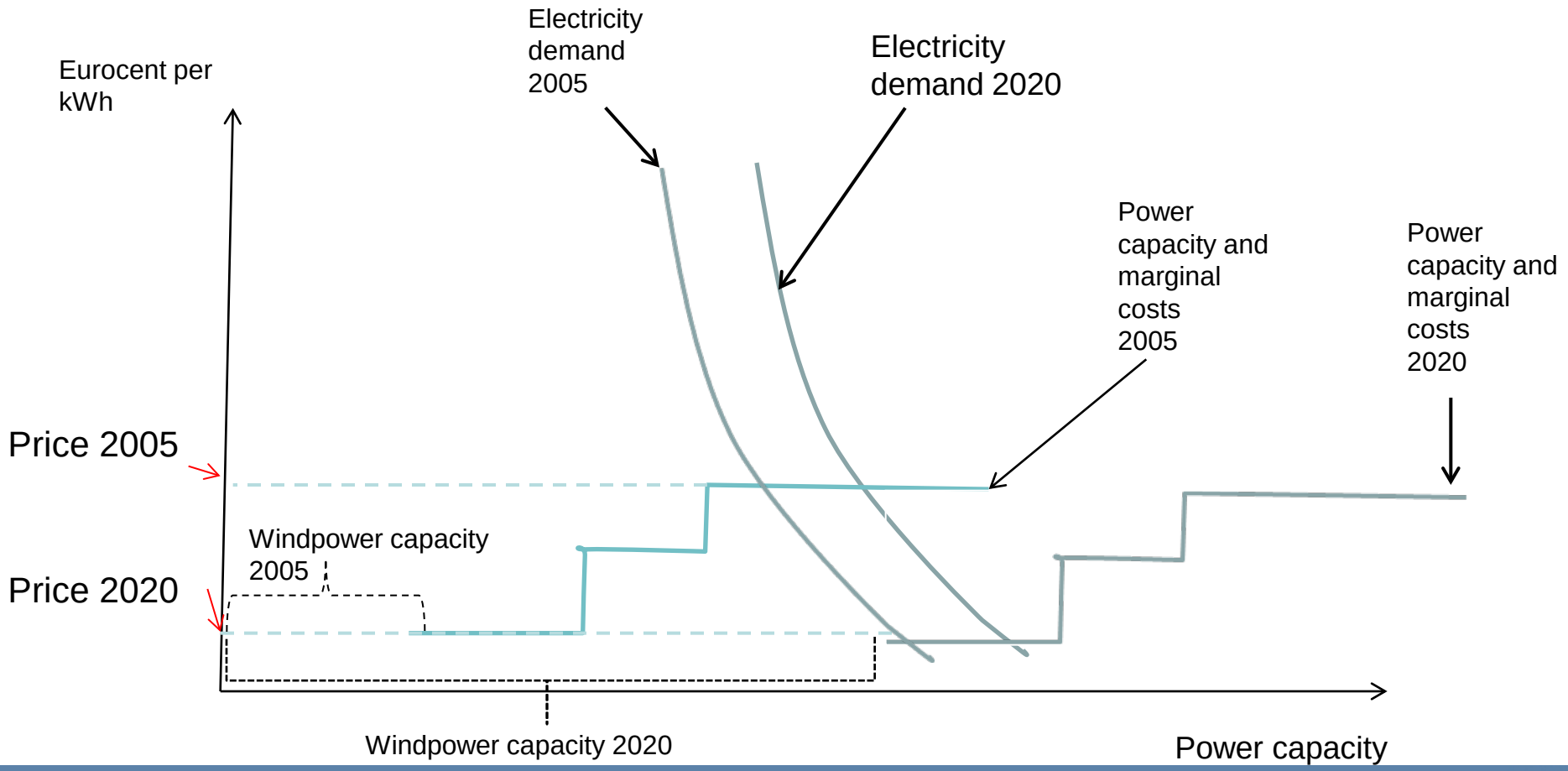
Eurocent per kWh

Japan industrial electricity price before 11/3 2011. Around 10 Eurocent/kWh.

Denmark
(In 2013 30% wind power)



The merit order effect or the economic suicide of wind power on the present power market.



2. Januar 2014-

a rather typical windy January night.

Midnight to 0800

1. Wind power production 26108 MWh sold for an average price of 7 Euro per MWh at the Nordpool market.
2. It could have saved gas/oil/biomass for 53 Euro per MWh, so the loss because of market failure is 46 Euro per MWh.
3. Accummulated loss due to market failure in the eight hours between midnight and 0800 on 2/1 2014 =

26108X46 Euro = 1,200,968 Euro.

6. Policies for smart energy systems

a. Reduce wind power costs

b. In crease wind power value

Reduce wind power costs

More onshore and less offshore in 2020

(a proposal)

1. 550 MW (instead of 1000 MW) new offshore capacity.

2. 500 MW new ”nearshore” capacity.

3. Replacement of 1300 MW onshore with 2600 MW (Instead of 1800 MW)onshore (Plus 800 MW)

We replace around 1.75 billion kWh offshore (14 Eurocent/kWh) with onshore production (7 Eurocent/kWh). Annually saving around 122 million Euro in Public Service Payment.

Policies for local ownership

1. Establish a legislation that makes it a must that any wind power project shall have at least 60% local ownership. (Defined as ownership by municipalities,local companies, local households etc.)

2. That investors investing in flexibility infrastructure such as heat pumps, heat storage, electric car which can be regulated according to system needs, should have first priority as owners of wind power shares.

3. Independent auditors should check the prices of wind power shares,when a company sells wind power shares to local- and regional actors.

4. Give municipalities right to use the surplus from wind power projects to any purpose. (Today they can only use it within the electricity sector)

5. A legislation should be in place that statues a broad acces to investing in offshore plants.

6. Free funds should be made available for newcomer investors in wind power projects. In order to open the road for more bidders and more competition.

Increase wind power value-

by local ownership , onshore wind and an adequate flexibility infrastructure.

Does this change happen with the present tax and incentive system?

NO!!

	1. N-Gas-cons. lev.	2. Oil heat cons. lev.	3. Windpower el.	4.Heat pumps
1. Energy price excl. tax wholesale level			40,0	*40,0*
2. CO2 costs Nordpool			5,6	*5,6*
3. Distribution/transmission			32,7	*30,0*
4. Energy price consumer level excl.tax	35,0	80,0	78,3	*75,6*
5. Energy tax	27,5	27,5	83,2	*44,1*
6. PSO(Public Service Obligation)			24,3	*24,3*
7. CO2 tax.	4,3	5,5	8,5	*8,4*
8. Energy price incl. tax/excl VAT	66,8	85,5	194,3	*152,4*
9. VAT	16,7	21,4	48,6	*38,1*
10. Energy price incl. tax and incl. VAT	***83,5***	***106,9***	***242,9***	***190,5***
11. All taxes incl. VAT per MWh "fuel" (1)	***48,5***	***54,4***	***170,2***	***120,5***
12. Tax per MWh at consumer level (2)	**53,9**	**60,4**	**56,7**	***40,2***

Table 1. *Costs and taxes of different heat alternatives in Denmark (euro per MWh)*

Market failures due to transmission and distribution payment- the need for Grid ”ROADPRICING”

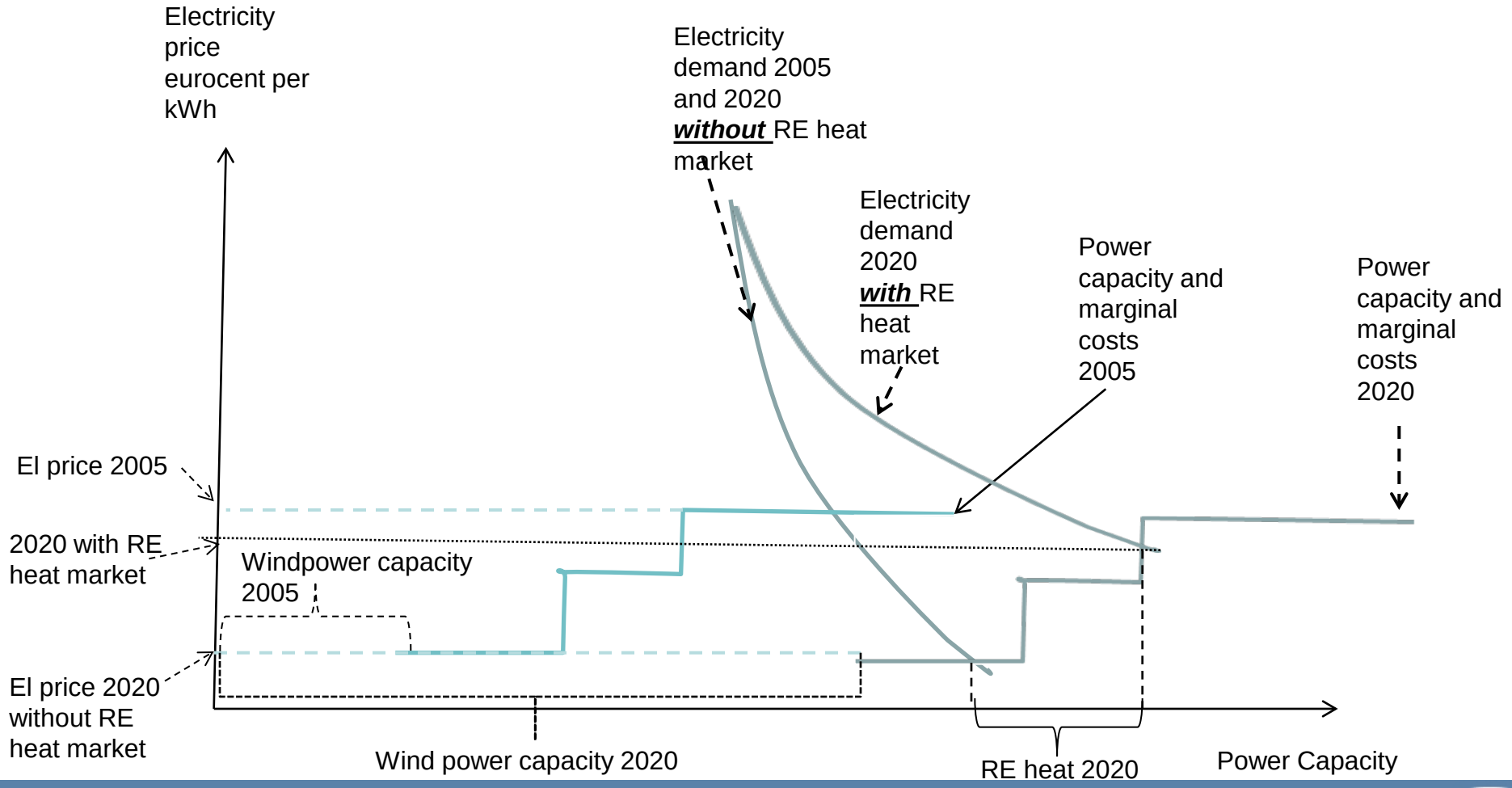
1. Even when selling wind power for heat to your neighbour, you pay a transmisison fee of 0,9 Eurocent per kWh.

2. And when using the distribution network in the night outside peak hours, where the marginal costs of distribution are zero, you pay average distribution costs of around 2 Eurocent per kWh.

3. So when selling to neighbour heat markets, wind power could be exempt from paying transmission costs. And the distribution costs should be considerable reduced.

This change to a more market cost related transmission and distribution costs could reduce the wind power price for heat by around 3 Eurocent per kWh.

Integrating electricity and RE heat markets and RE price increase



Policies for the integration of heat and electricity markets

1. Reduce electricity tax from 120,5 Euro to 45 Euro per MWh for electricity for heat (Note that this same as for oil and gas, and much higher than on biomass).

2. Electricity ”road pricing” by market conform payment for transmission and distribution. (reducing these payments by around 30 Euro per MWh electricity for heat.)

   1+2 reductions should only be applied for consumers certified as defined under 3-5 below:

3. Obligation to buy wind power shares in new wind power capacity equivalent to the annual use of electricity for heat consumption.
4. Obligation to keep a cogeneration capacity alive equivalent to the annual max. use of electricity. (This reduces the need for importing electricity in periods of no wind, and thus saves investments in transmission grid systems!!)

5. Obligation to establish a heat pump and hot water storage system at a by the TSO specified size.

These requirements should make sure:

a. That the lowered tax is not furthering the use of fossil fuel based electric heating.

b. That the transaction costs linked to the establishment of a flexibility infrastructure is kept low.

c. That a learning proces between owners of wind turbines and owners of flexibility infrastructure should be established.

Flexibility infrastructure policies

Establish a policy that supports:

- The survival of CHP plants.
- That CHP plants participates in regulation activities at the NORDPOOL market.
- Establishment of needed heat storage capacity.
- Establishment of needed heat pump capacity
- Establishment of a system with ”plug in” electrical cars.
- Electricity ROAD PRICING! Pay for transmission, when you use it , and dont pay, if you dont use it.
- Establish ”Energinet” (Danish TSO) procedures for the establishment of an Renewable Energy flexibility infrastructure.
- Establish a policy for the development and implementation of syngas systems.
- And most importantly establish ownership preference to wind turbines shares from organizations that establishes the flexibility infrastructure.
- Etc.

How much is the value of wind power increased by integrating heat and electricity markets?

1. If electricity from wind turbines is sold at lower prices than the most expensive heat alternative, the energy market is malfunctioning.

2. Stopping wind turbines in periods where there is a need for heating, hot water and transportation, the market functions badly , and has to be repaired. So in that case, dont stop the wind turbines- repair the market!

3. Based on calculations made by H.Lund and E. Münster (2004), the electricity the value of wind power increases by around 1.5 Eurocent/kWh when establishing the needed integration of -amongst others the heat- and electricity markets.

Results

1. Local/regional ownership furthers local acceptance and thus makes more onshore wind power possible
2. Increased onshore share reduces wind power cost, as onshore costs are around 50% of offshore costs!
3. Local/regional ownership by district heating companies and heat consumers, facilitates the integration of heat and electricity market.
4. Integration of the electricity and heat market with heat pumps and heat storage systems keeps the value of wind power relatively high (above the cost of the most expensive heat fuel).
5. Point 2 reduces wind power costs and point 4 increases wind power value.
6. As a result, the economy of wind power is improved considerably, which again increases the political support and makes a further increase of wind power possible.

Expected Public Service Obligation (PSO) costs in 2020 (Present wind-power policy)

BEFORE LOCAL OWNERSHIP AND HEAT/POWER INTEGRATION

	Offshore	**Near-shore**	**Onshore**	**Sum of all wind power projects**
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PSO payment after integrating the heat and electricity market and improving the rate of local ownership.
2020 wind power plans.

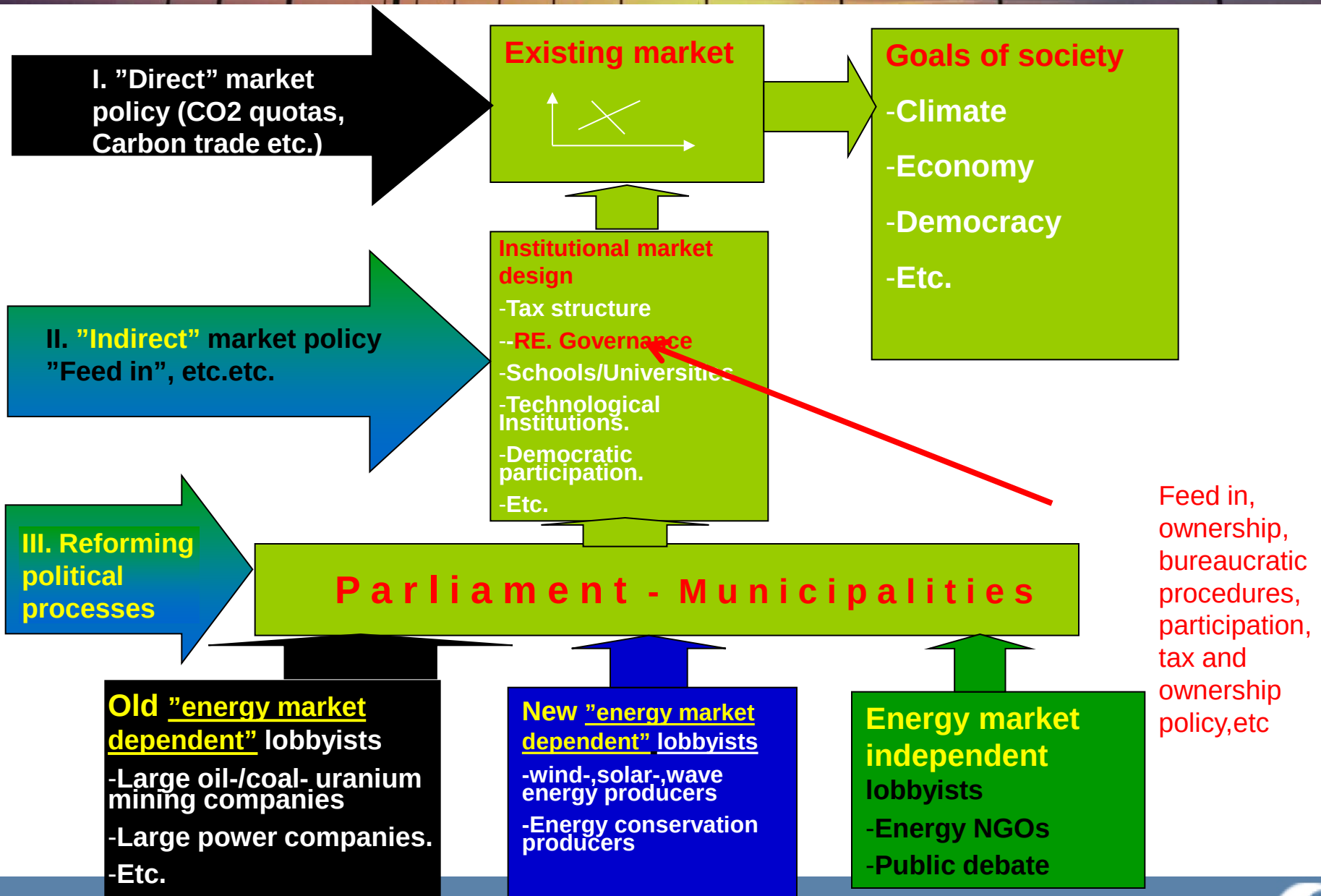
	1.Offshore	2.Near-shore	3.Onshore	4.Sum
1. Anholt (2012-2014)	400 MW			
2.New	450 MW	500	2,600 (net increase from 1,100 MW today)	
3.Production in MWh	3,230,000 (3,800 MWh/MW/year)	1,650,000 (3,300 MWh/KW/year)	5,720,000 (2,200 MWh/MW/year)	
4.PSO payment in euro per MWh	85	35	15	
5.Sum PSO payments in million euro/year	275	57	86	418 (Or around 1 eurocent per kWh.)

Annual saving/earnings in 2020

1. PSO saving approximately 2.5 billion DKR (350 million Euro).

2. Regional and local annual net gains by 60% local and regional ownership. Approx. 1 billion DKR.

Innovative democracy



Thank you!