



THE EFFECTS OF AN AMBITIOUS DANISH ENERGY POLICY

BY

PROFESSOR EIRIK S. AMUNDSEN,

*UNIVERSITY OF BERGEN, NORWAY AND UNIVERSITY OF COPENHAGEN, DENMARK,
CHAIRMAN OF THE DANISH ECONOMIC COUNCILS*

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Danish energy and climate policy

- Danish energy and climate policy is to a large extent governed by EU's policy of «2020 by 2020»
- Denmark's obligations towards EU are:
 - Participate in the creation of a European internal energy market
 - *GHG emission:*
 - Quota sector: Participate in the common quota market (EU ETS)
 - Non-quota sector: Reduce emission of GHG by 20 pct as compared with 2005
 - *Share of renewables:* Attain 30 pct by 2020
 - *Energy efficiency/ saving:* Reduce energy consumption by 4 pct as compared with 2006

Danish energy and climate policy

- Denmark's additional national targets (the Energy Accord of 2008 and the Energy Agreement of 2012 of the Danish Parliament):
 - Reduce GHG emissions **in Denmark** by 40 pct by 2020
 - Wind power should cover at least 50 pct of total electricity consumption in Denmark by 2020
 - Phase out coal from electricity and heat generation by 2030
 - 100 pct renewables in electricity and heat generation by 2035
 - Denmark should be «fossil free» by 2050

Danish policy of renewable energy

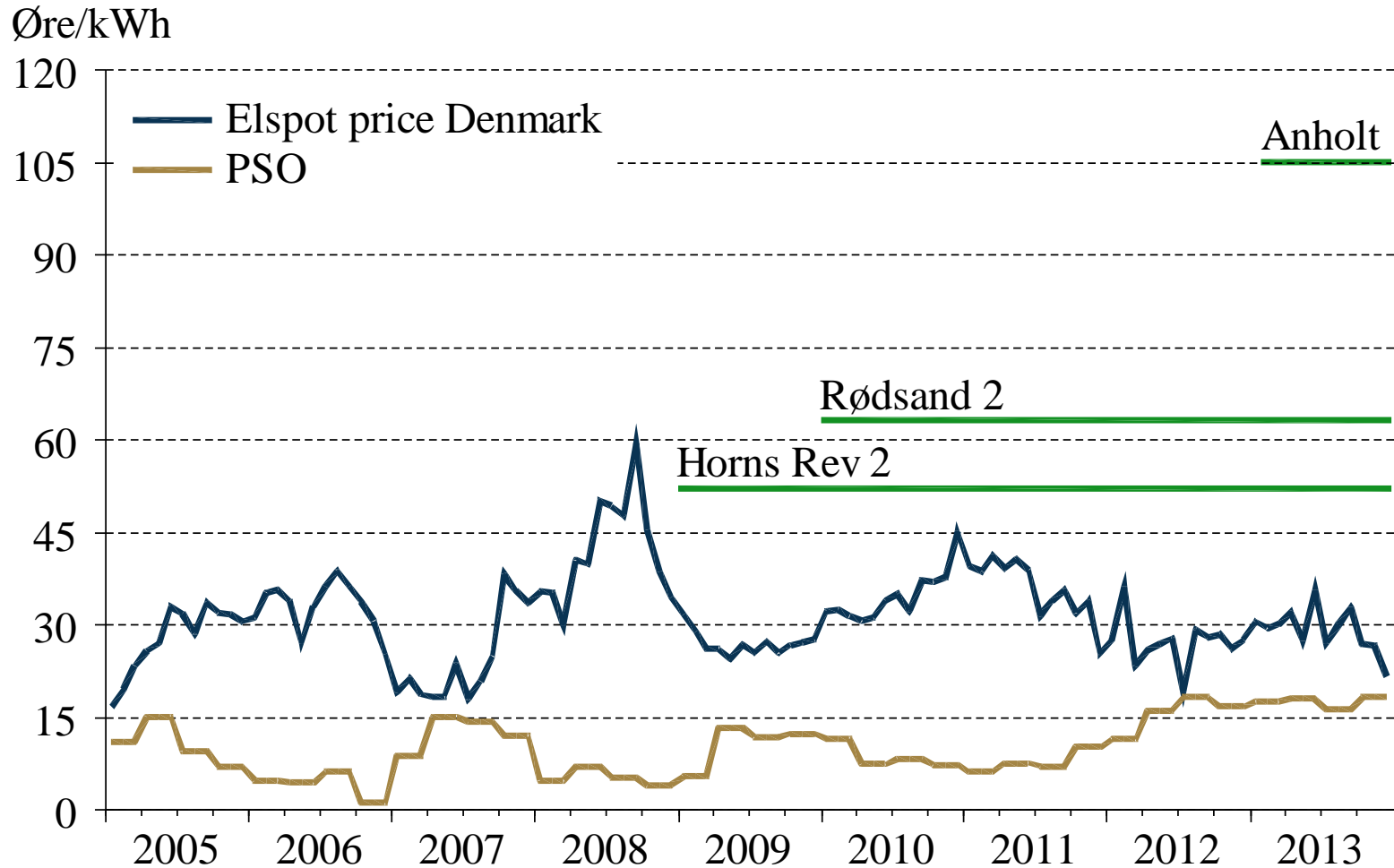
- Plans based on the 2012 Energy Agreement amount to increasing the wind power capacity by building two large offshore wind power plants (Horns Rev 3 and Kriegers Flak), as well as additional onshore and close to coast wind power projects and bioenergy.
- These plans will result in a share of renewables of 35 pct in 2020 i.e. 5 pct points more than what is required by EU
- **The question is: What does this cost and what are the benefits?**
- The question of costs is also linked to the way finance of the plans is obtained (the PSO)

Subsidies for renewable energy in Denmark (2013)

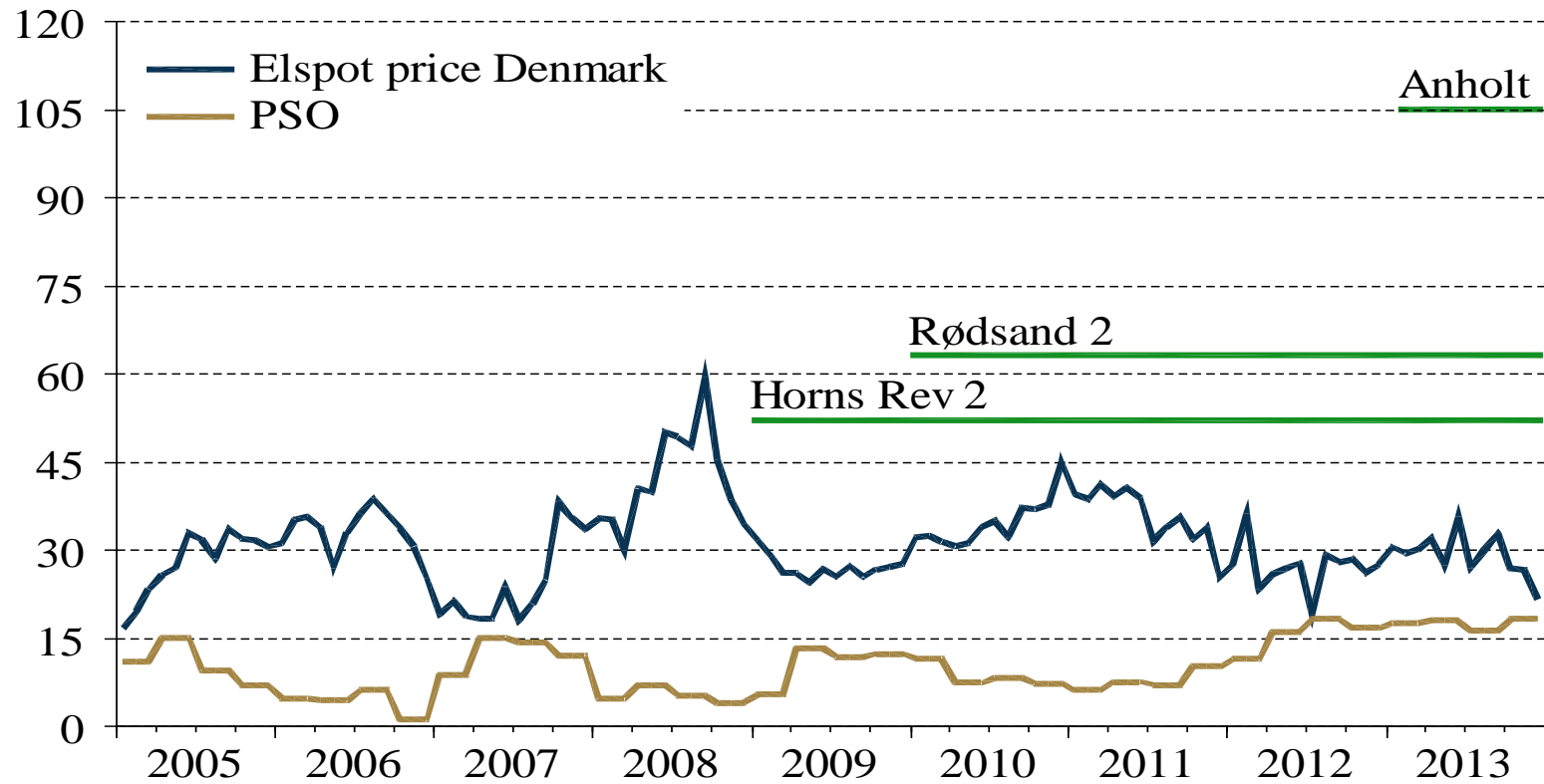
- **Offshore wind power:** Guaranteed price composed of the electricity wholesale price plus a residual subsidy (making up the guaranteed price). The guarantee is valid for the first 50.000 hours of full load capacity.
- **Onshore wind power:** 25 øre, being reduced øre by øre as the wholesale price increases above 33 øre per kWh. Guarantee valid for the first 22.000 hours of full load capacity.
- **Solar energy:** 60 øre per kWh first 10 years, then 40 øre for next 10 years.
- **Biogas and biomass:** 15 øre and 43 øre per kWh, respect.
(100 øre=DKK 1=EUR 0,13=GBP 0.11=USD 0,18).

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Guaranteed prices and development of Elspot price and PSO tarif



Øre/kWh



Subsidies of wind power depend on installation year

Instal. year	Onshore wind		Offshore wind	
	Subsidy first year	Avg. subsidy over lifespan	Subsidy first year	Avg. subsidy over lifespan
----- Øre/kWh -----				
2017	21	7	53	30
2020	16	4	48	26
2023	8	2	40	23
2028	0	0	•	•

The columns “Average subsidy over lifespan” are the present values of all subsidies in the years of subsidies converted to an annuity for the lifespan of the mill. For offshore wind the guaranteed price is 90 øre per kWh. (100 øre=DKK 1=EUR 0,13=GBP 0.11=USD 0,18).

Composition of the end user electricity price

Electric power	38,6	38,6	28,9
Subscription	2,7	0,1	0,1
Local transmission (distribution)	16,0	14,0	3,6
Of which energy savings	2,0	2,0	2,0
Subscription (net)	15,8	3,7	0,5
Regional transmission	1,0	1,0	0,5
Net- and system tariffs	7,6	7,6	7,6
Elprices before PSO and taxes	81,6	64,9	41,2
PSO tariff	15,5	15,5	15,5
Elprices before taxes	97,1	80,5	56,2
Tax	69,6	3,0	3,0
Distribution tax	4,0	1,0	0,0
Electricity savings contribution	0,6	•	•
CO ₂ tax	6,4	6,3	5,1
VAT	44,4	•	•
End user price	222,2	90,8	64,8
PSO share of end user price	7%	17%	24%
Elspot price 2012	27,5	27,5	27,5

- a) "Electric energy" for households and small firms is the price paid through a public controlled intermediary. Large firms buy directly on the spot market and therefore their price is close to the spot price.
- b) This component is the total expenditures for energy savings financed by the distribution companies divided by the usage of electricity.
- c) 100 øre=DKK 1=EUR 0,13=GBP 0,11= USD 0,18

Subsidies for renewable energy (PSO) and energy savings

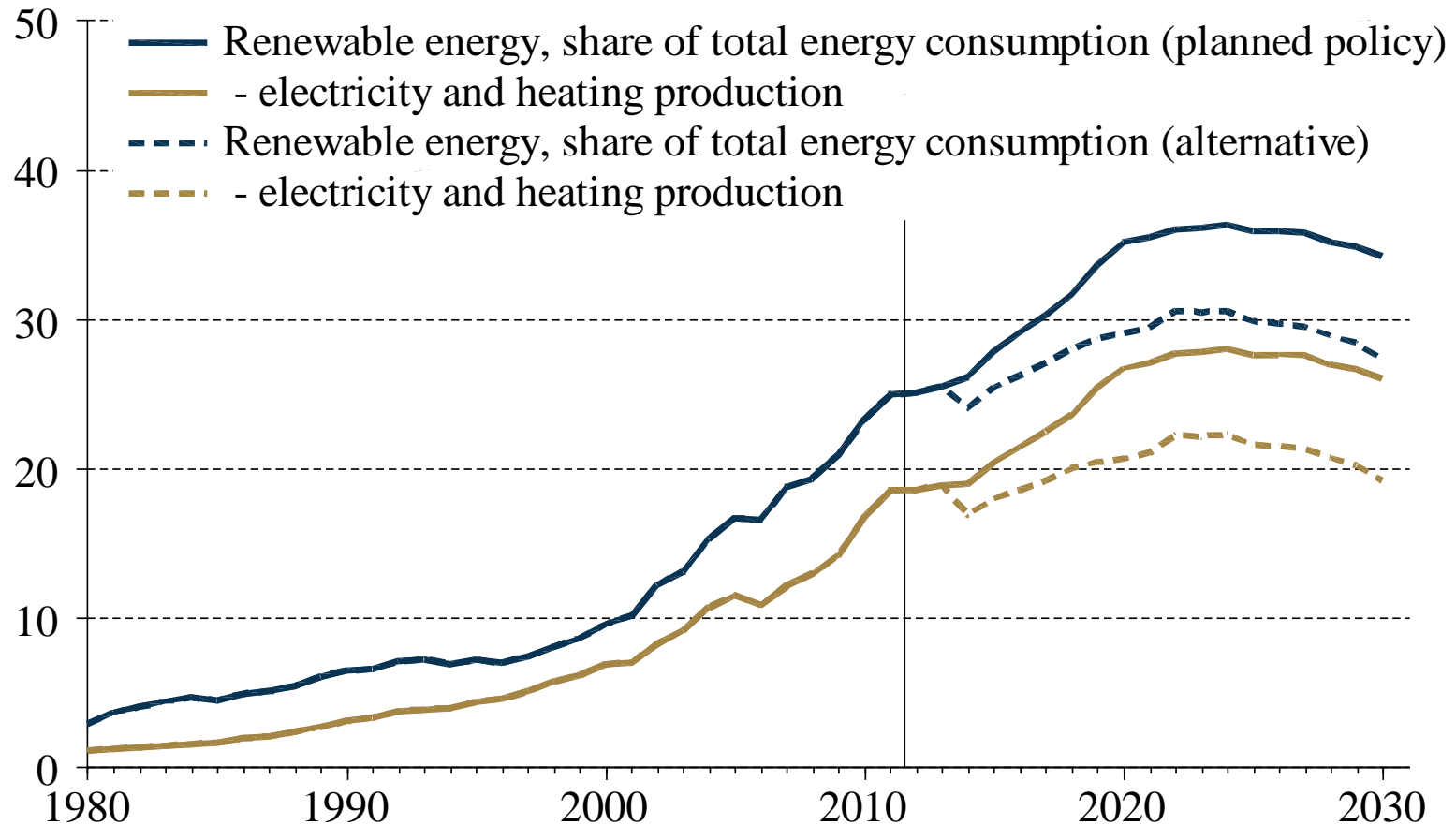
	2011	2012
	----- m DKK -----	-----
PSO collected	2.601	5.121
Of which subsidy to offshore wind	591	1.007
subsidy to onshore wind	867	1.288
subsidy to biomass and biogas	483	458
R & D	240	219
subsidy to local CHP	482	1.228
the remainder	-62	921
Contribution, energy savings	711	783
Total	3.312	5.904

Modeling two scenarios

- We consider two scenarios: the *Current Policy* scenario and the *No-Subsidy Policy* scenario
 - *Current Policy*: The renewable energy policy as determined by the Energy Agreement of 2012
 - *No-Subsidy Policy*: All future support of renewable energy based on wind, solar, biomass and biogas is terminated except for projects already in operation (in 2013)
- Models:
 - Effects on the market: Balmorel and DEMS
 - Macroeconomic effects: SMEC

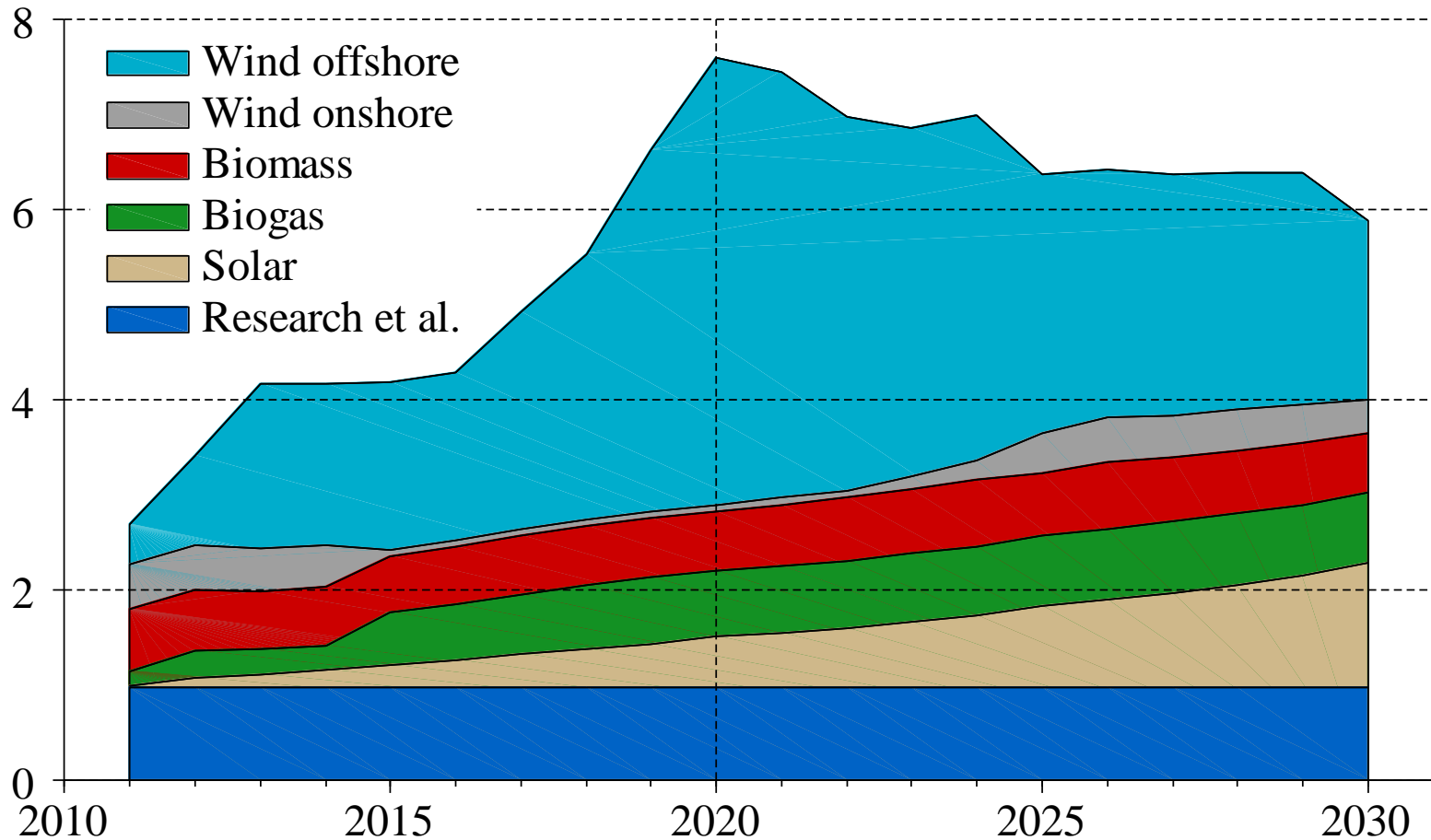
Development of share of renewable energy

Per cent



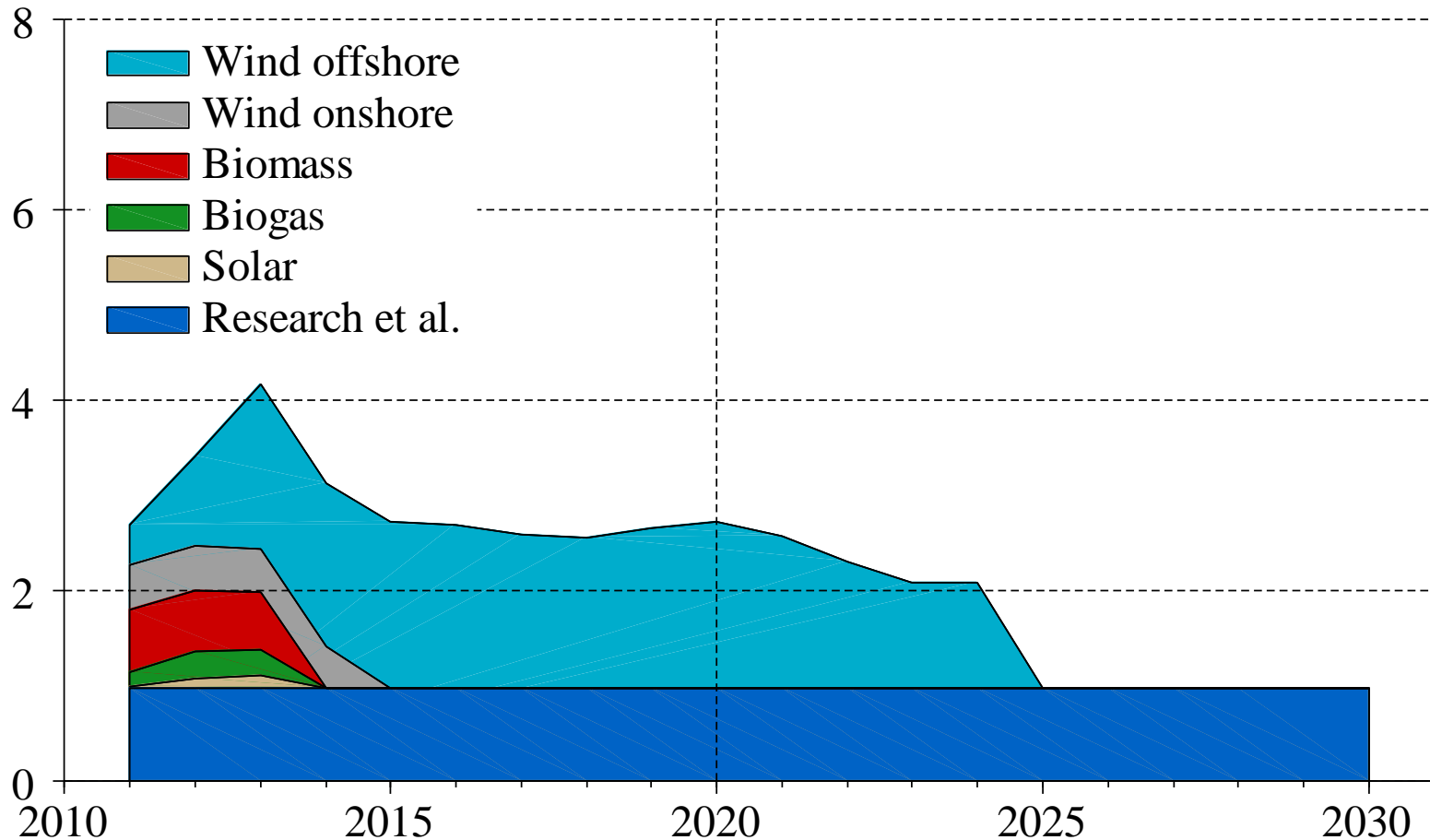
Development of PSO-based subsidies under *Current Policy* scenario

2013-DKK bn



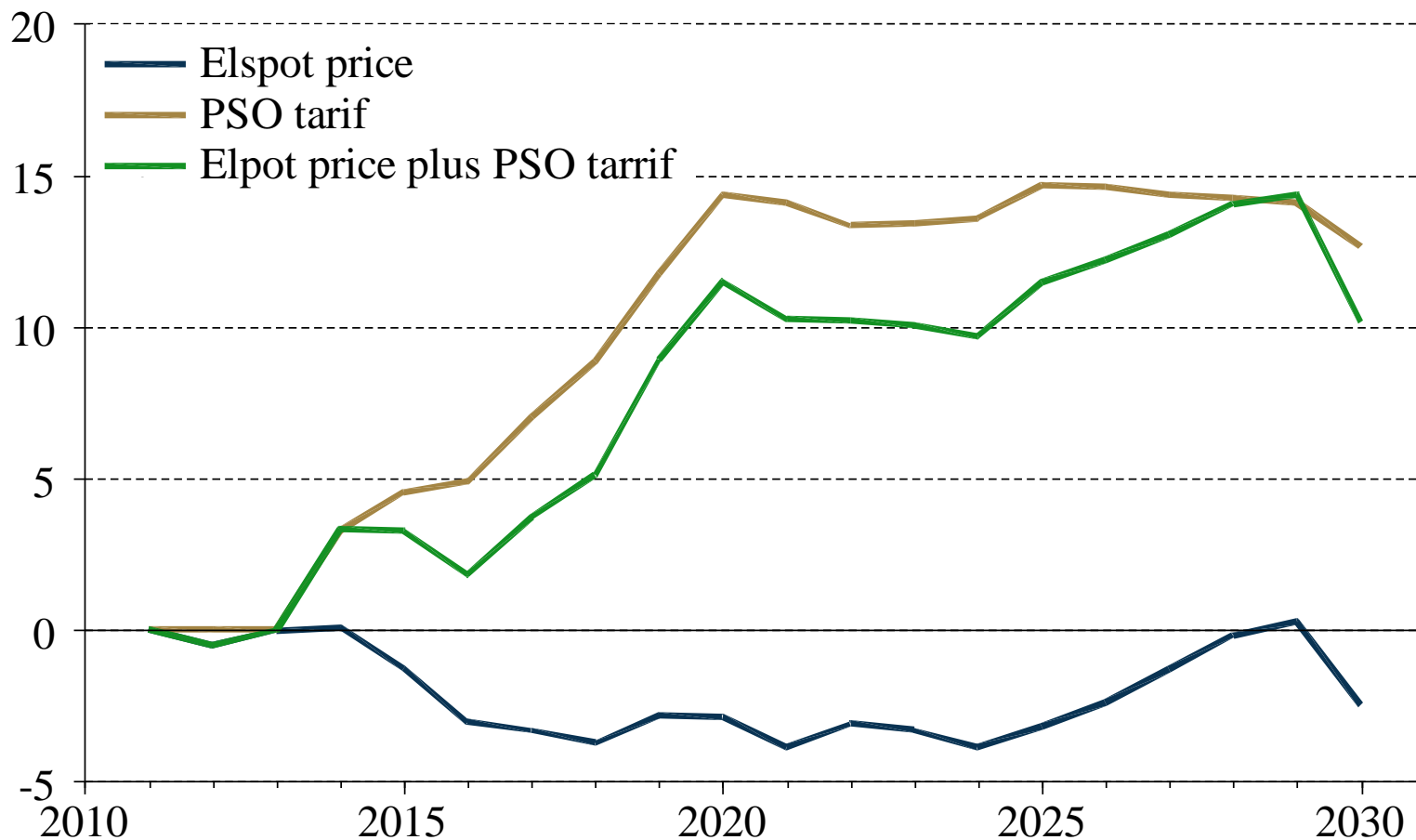
Development of PSO-based subsidies under *No-Subsidy Policy* scenario

2013-DKK bn



Development of Elspot price and PSO tarif

2013-øre/kWh



Electricity price, subsidies, and renewable energy in two scenarios

Scenario	Base	Current Policy	No- Subsidy Policy
Year	2011	2020	2020
Elspot price, 2013-øre/kWh	37,6	42,5	45,4
PSO tariff 2013-øre/kWh	7,9	22,3	7,9
PSO million 2013-DKK	2.696	7.594	2.721
Onshore wind power, MW	2.858	2.899	2.616
Offshore wind power, MW	868	2.763	1.268
El. generated from wind, pct.	28	47	29
El. generated from other renewables, pct.	13	20	14
El. generated from fossil fuels, pct.	59	33	57
Renewable energy in Denmark, pct.	24,9	35,1	29,0

(100 øre=DKK 1=EUR 0,13=GBP 0.11=USD 0,18)

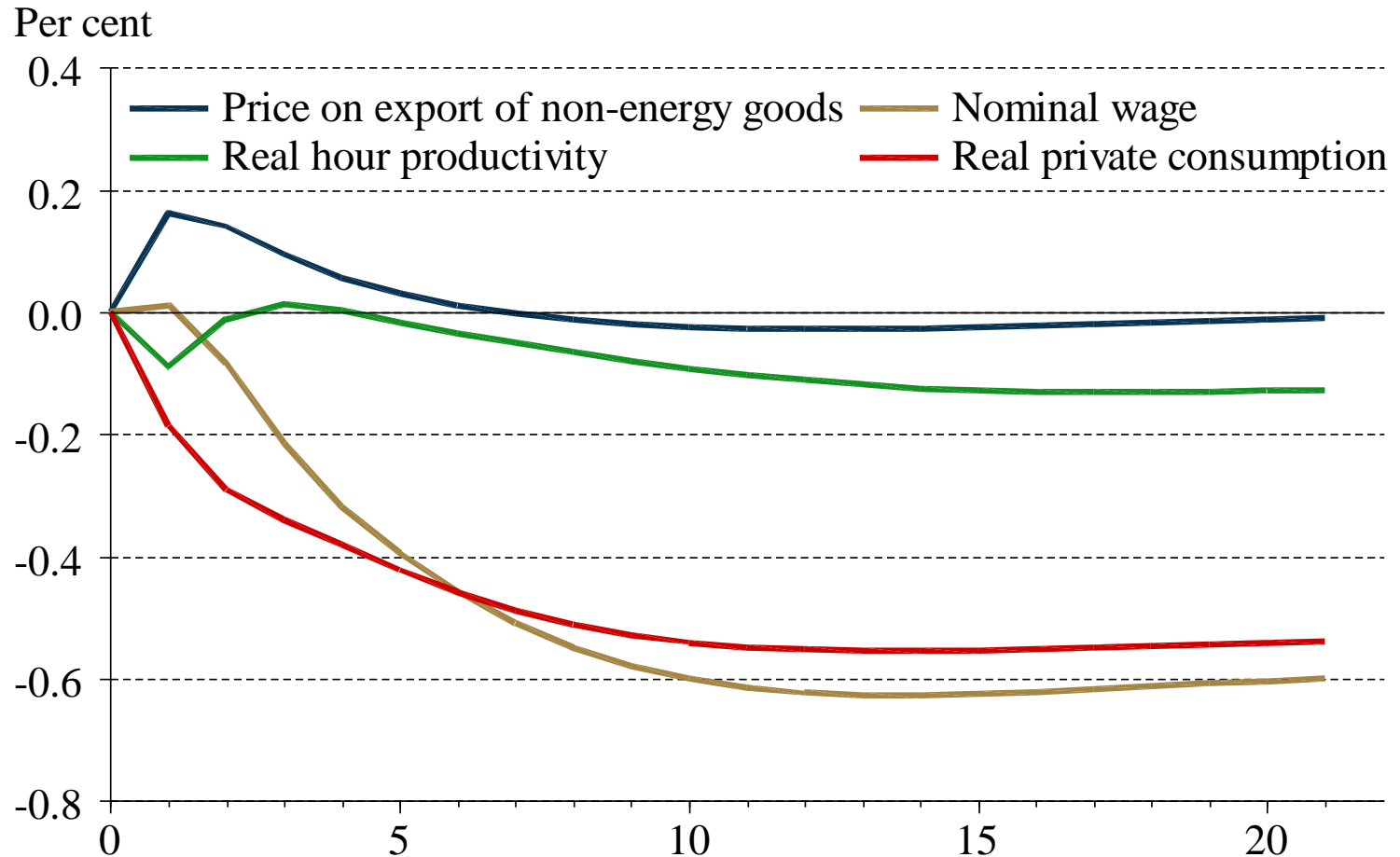
Results of *Current Policy*

- **End user electricity price (spot + PSO):** 15 pct. increase (ca. 10.5 øre per kWh).
- **Direct costs:** Additional annual PSO-bill of DKK 5 billion for 10 to 20 years into the future
- **Share of renewable energy:** *Current Policy:* 35 pct. in 2020, EU-requirement: 30 pct. *No-Subsidy Policy* 29 pct.
- **Macroeconomic effects:** Calculations based on a 15 pct. increase of electricity prices in Denmark
 - Reduction of employment of 5 – 6.000 after next 3 years, then slow return to long run equilibrium.
 - Reduction of productivity of some 0.25 pct.
 - Reduction of wage level of some 0.5 pct. in the long run
 - Reduction of private consumption of 0.5 in the long run.

Change of employment under the *Current Policy scenario*



Change of exports, wages, productivity and consumption under the *Current Policy scenario*



Benefits of an ambitious Danish policy on renewable energy

- GHG emission: Affects only demand of quotas, no quotas are removed from supply (allowed emission within EU ETS is unaffected) i.e. no direct effect on GHG emission.
- Security of supply: No direct effects on dependency on oil, and natural gas. Use of coal may be reduced, but there is no important security of supply problem for coal. However, security of supply in the sense of “brown outs” and “black outs” may actually be aggravated due to the increasing share of wind power.
- Technological spill-over effects from support: Small effects on research as measured by new patents (Bue Bjørner, 2013). Similar results as for Germany (EFI, 2014).

Conclusions

- The Danish renewable energy policy is costly with small benefits
- One should abandon/postpone the two large offshore wind parks
- Finance should be based on the income tax and not on a PSO
- Recent (July 2014) proposal from a majority of Danish political parties in the Parliament:
 - Reduce PSO by 3-5 øre on firms
 - Reduce PSO by 7 øre on electricity intensive firms
 - Reduce PSO on households (this is, however, counterbalanced by an increase of the electricity tax)
 - Postpone the construction of Kriegers Flak
- The EU - Commission is, however, not willing to accept the use of a PSO that is also levied on imported electricity, which is currently the case in Denmark.