The Scandinavian and European Electricity markets -Challenges and opportunities in times of transition.

20191125

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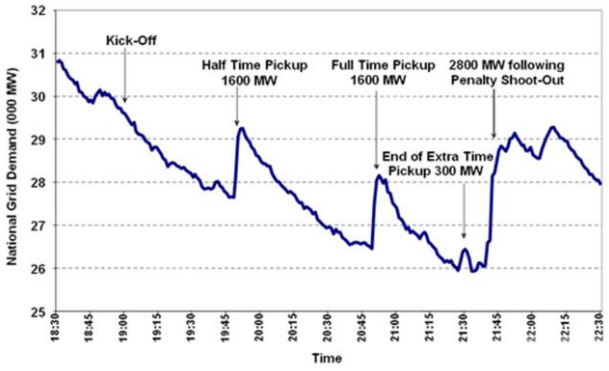
Södertörn University


Kick-Off
Half Time Pickup 1600 MW
Full Time Pickup 1600 MW
2800 MW following Penalty Shoot-Out
End of Extra Time Pickup 300 MW
National Grid Demand (000 MW)
Time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https://www.linkedin.com
Søren Dupont Kristensen Direktør, Systemudvikling og Elmarked @ Energinet.dk 17d
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Follow
Interconnected European grid reduces CO2 emissions. Here is the latest example from Denmark. Read our member Energinet.dk's environmental impact report for electricity 2015 here http://ow.ly/ZkWnO
Thanks to more wind power and
Large imports of electricity from Norway and Sweden
CO2 emissions from Danish power consumption were reduced by a third in 2015,


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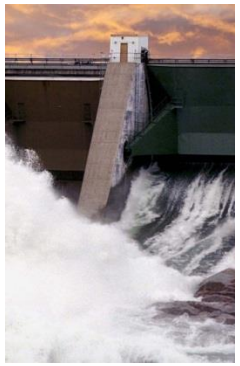
Nein zu
SÜDLINK



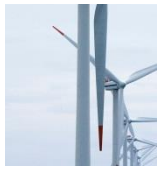
Several goals:

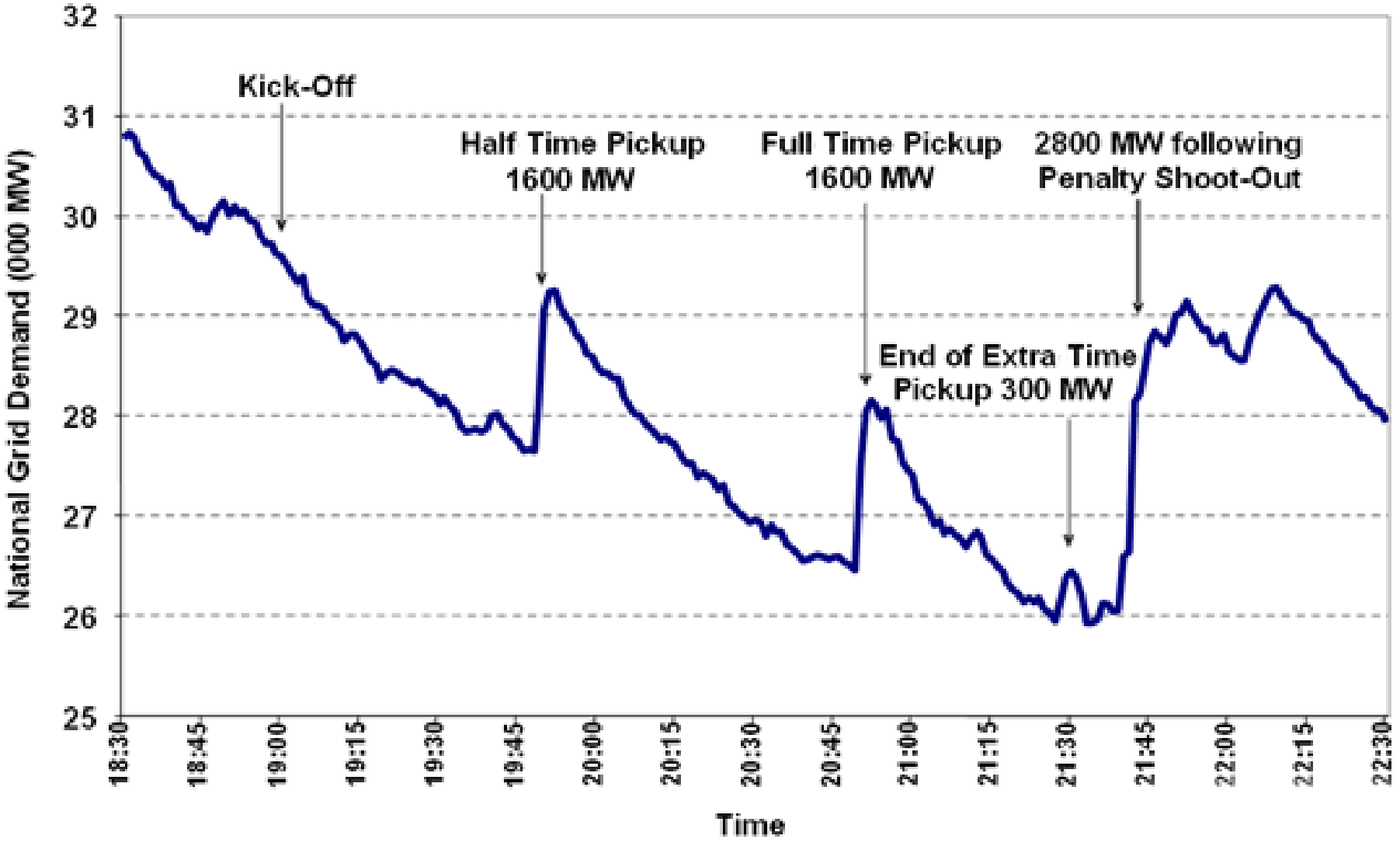
Climate change

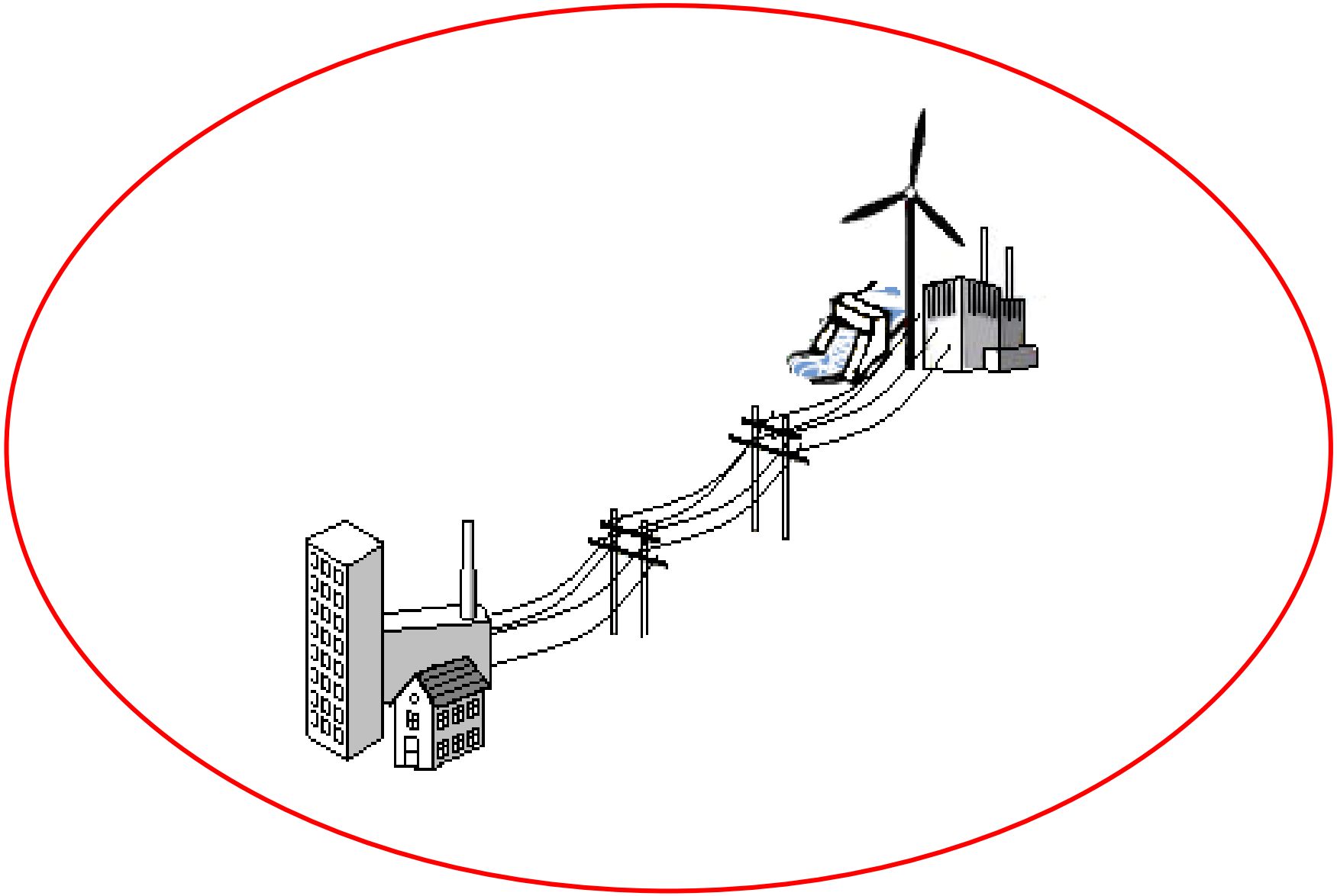
Renewal energy

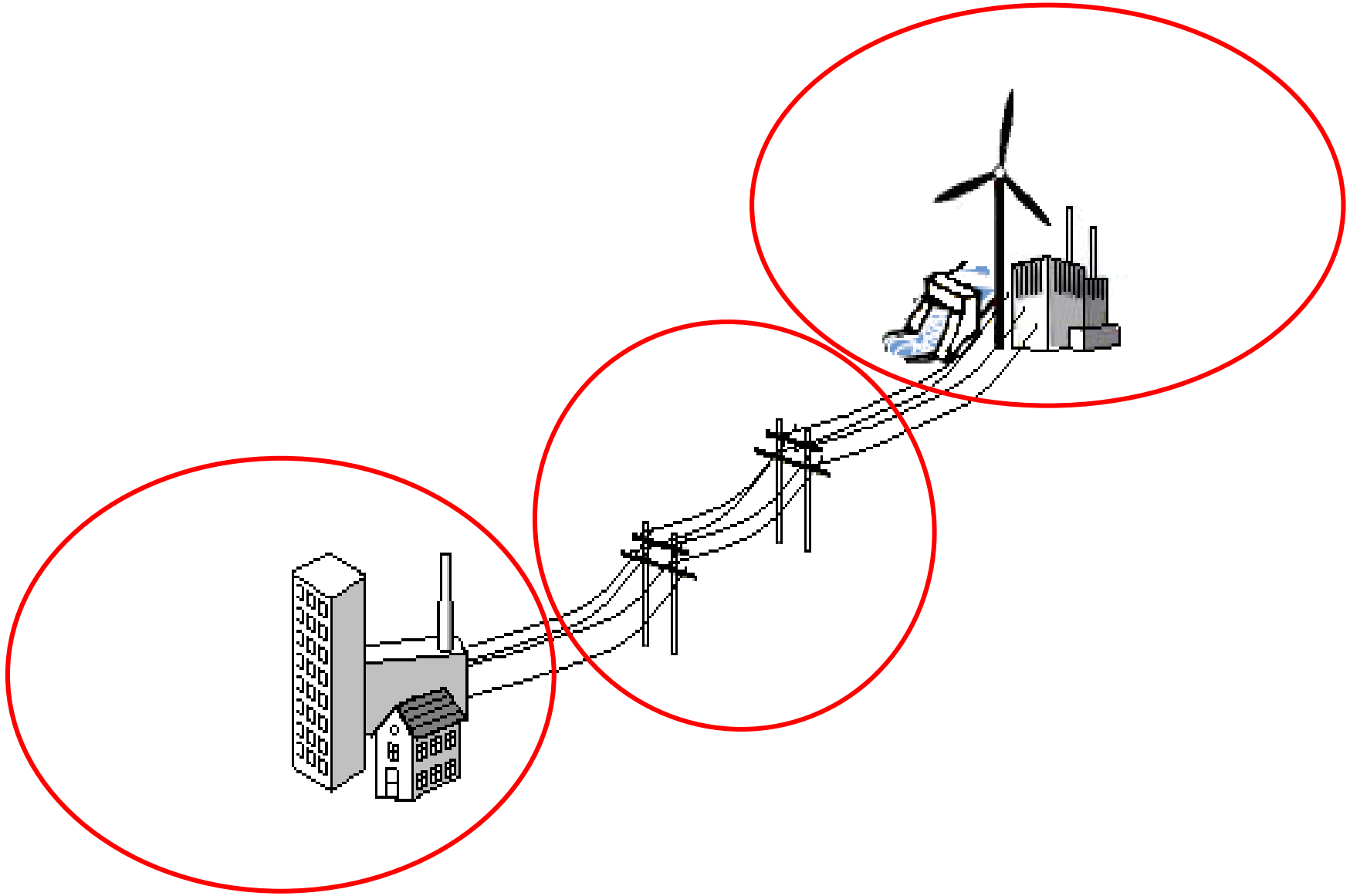
Affordable energy

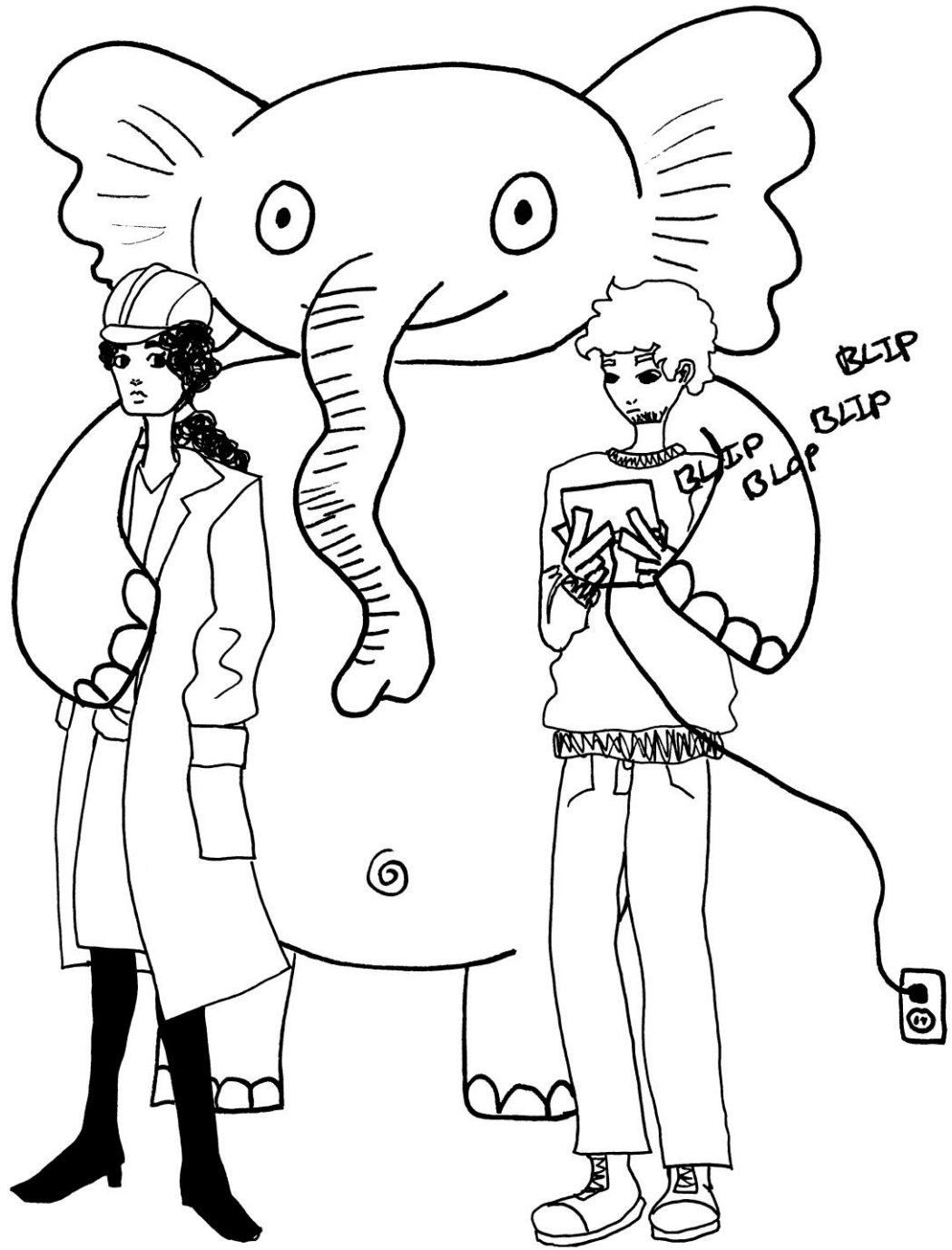
Seldom compatible!




National Grid Demand (000 MW)
32
31
30
29
28
27
26
25
Kick-Off
Half Time Pickup
1600 MW
Full Time Pickup
1600 MW
2800 MW following
Penalty Shoot-Out
End of Extra Time
Pickup 300 MW
18:30
18:45
19:00
19:15
19:30
19:45
20:00
20:15
20:30
20:45
21:00
21:15
21:30
21:45
22:00
22:15
22:30
Time



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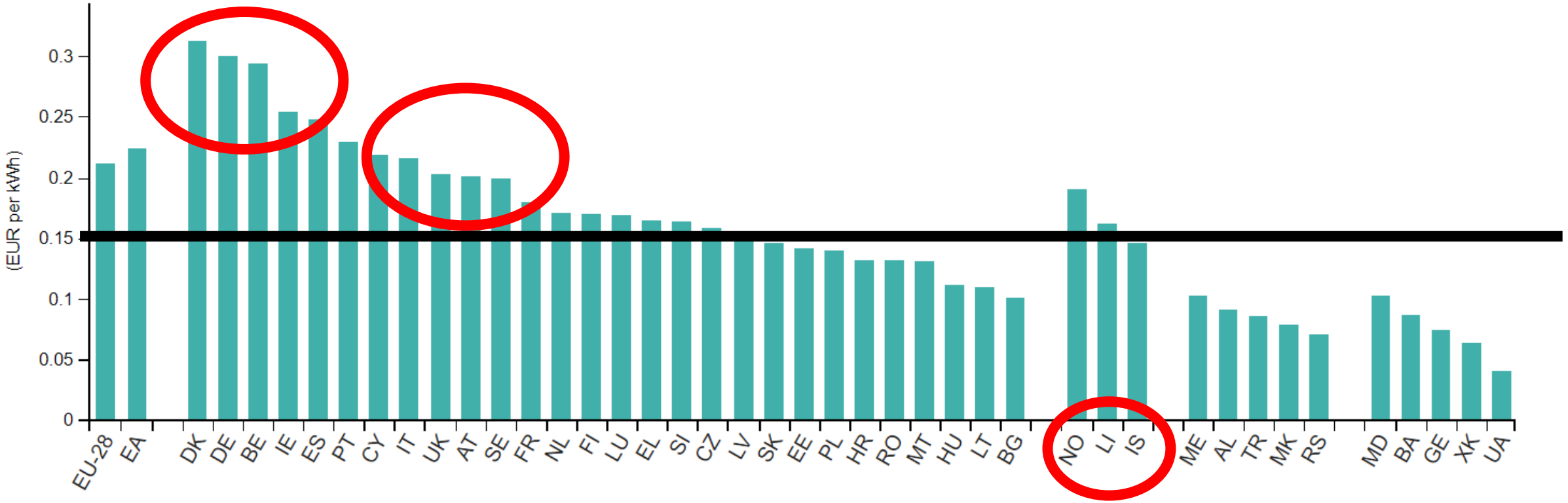
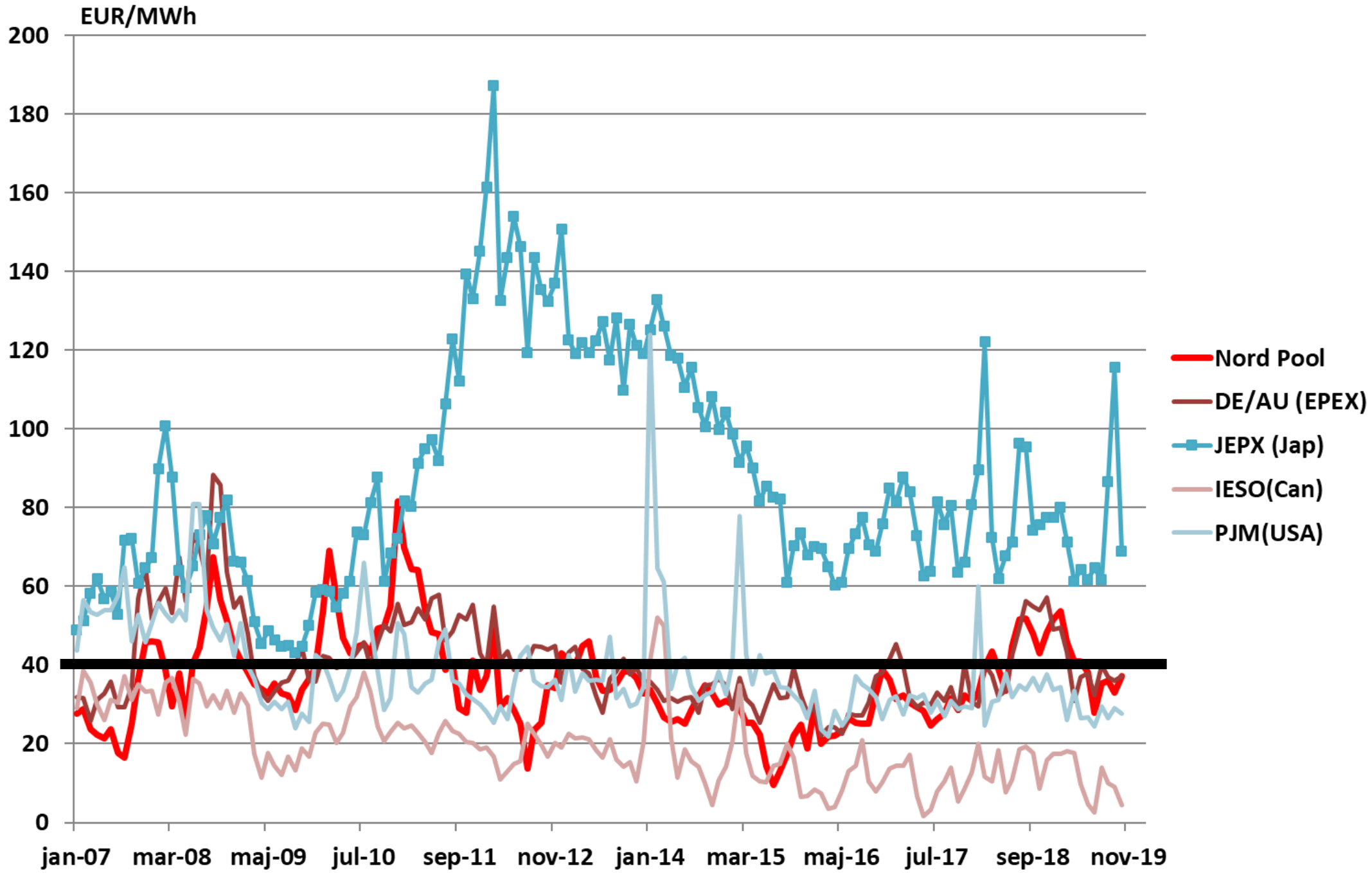
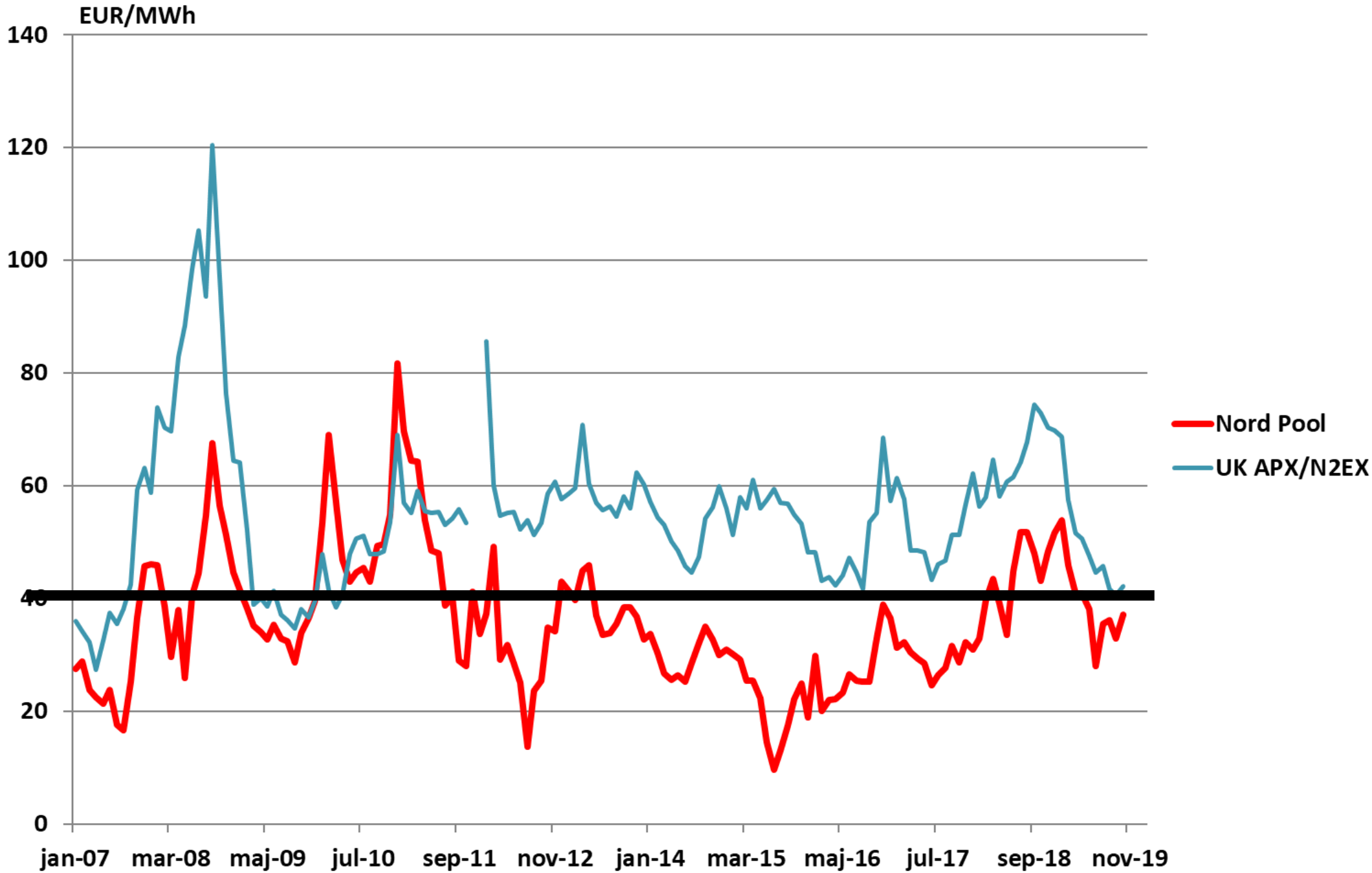
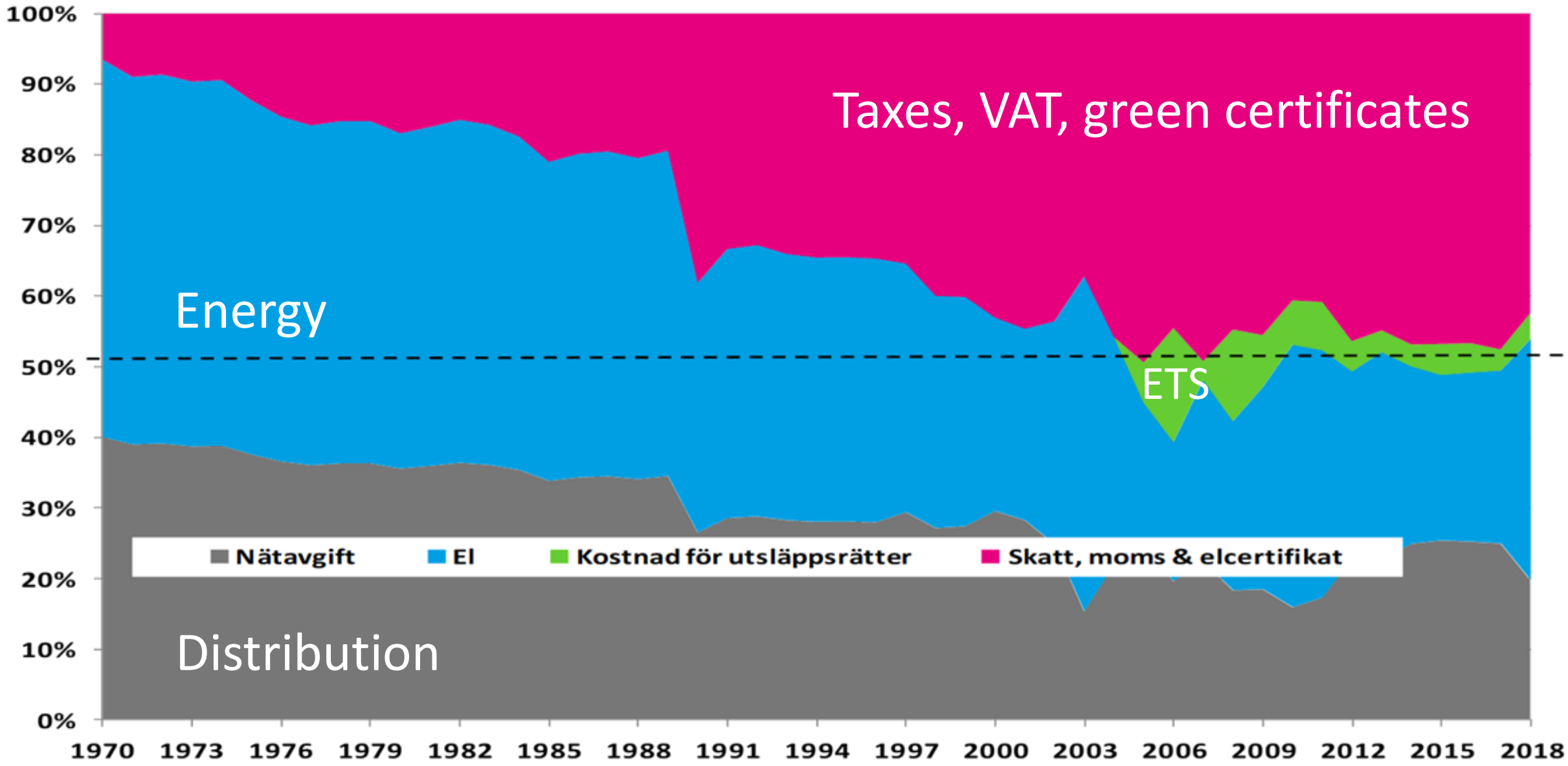
Prices

Electricity prices for household consumers (2 500 kWh < annual consumption < 5 000 kWh, taxes included), second semester 2018

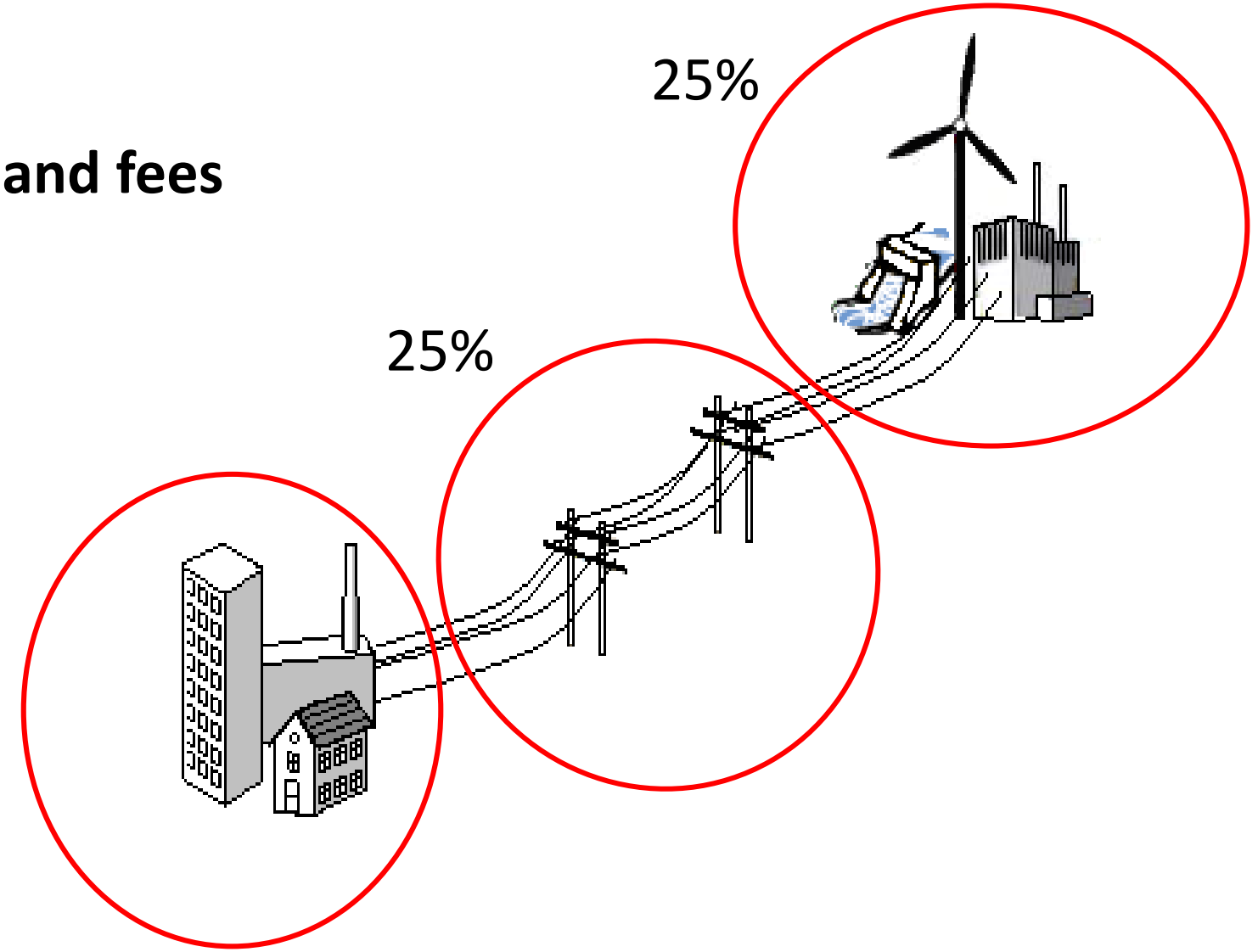


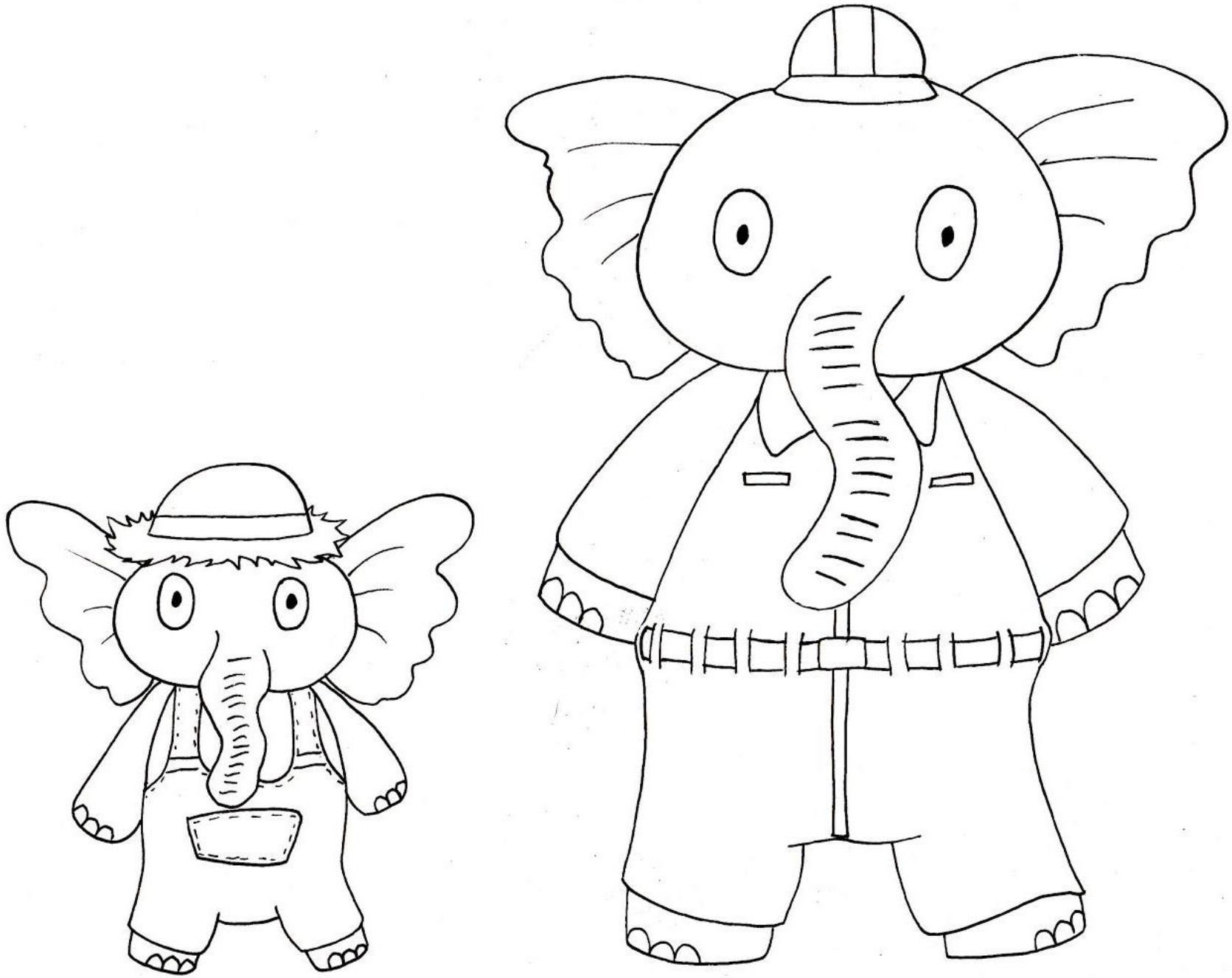

EUR/MWh
200
180
160
140
120
100
80
60
40
20
0
jan-07
mar-08
maj-09
jul-10
sep-11
nov-12
jan-14
mar-15
maj-16
jul-17
sep-18
nov-19
Nord Pool
DE/AU (EPEX)
JEPX (Jap)
IESO(Can)
PJM(USA)


EUR/MWh
140
120
100
80
60
40
20
0
jan-07
mar-08
maj-09
jul-10
sep-11
nov-12
jan-14
mar-15
maj-16
jul-17
sep-18
nov-19
Nord Pool
UK APX/N2EX

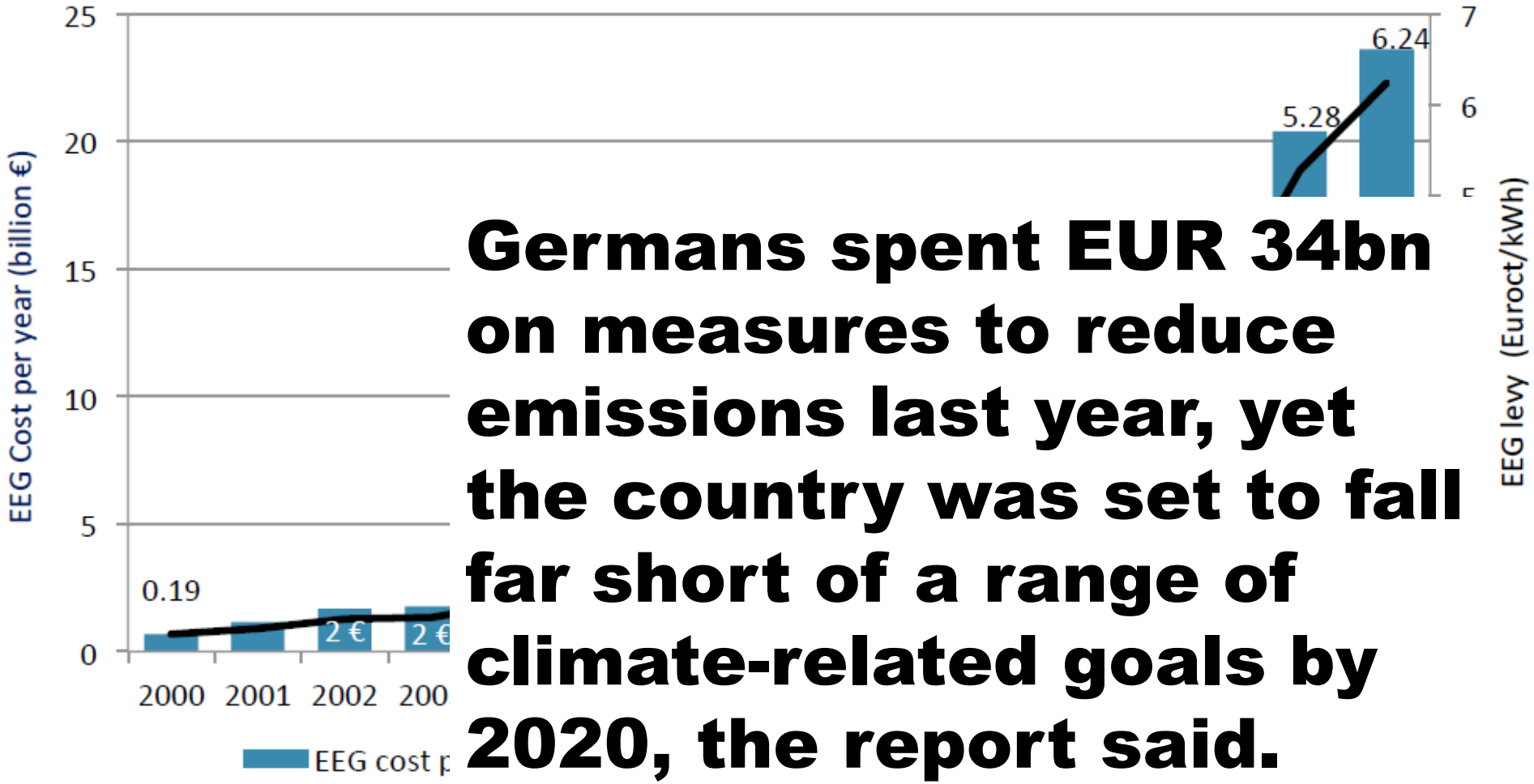

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
Taxes, VAT, green certificates
Energy
ETS
Distribution
Nätavgift
El
Kostnad för utsläppsrätter
Skatt, moms & elcertifikat

50% taxes and fees





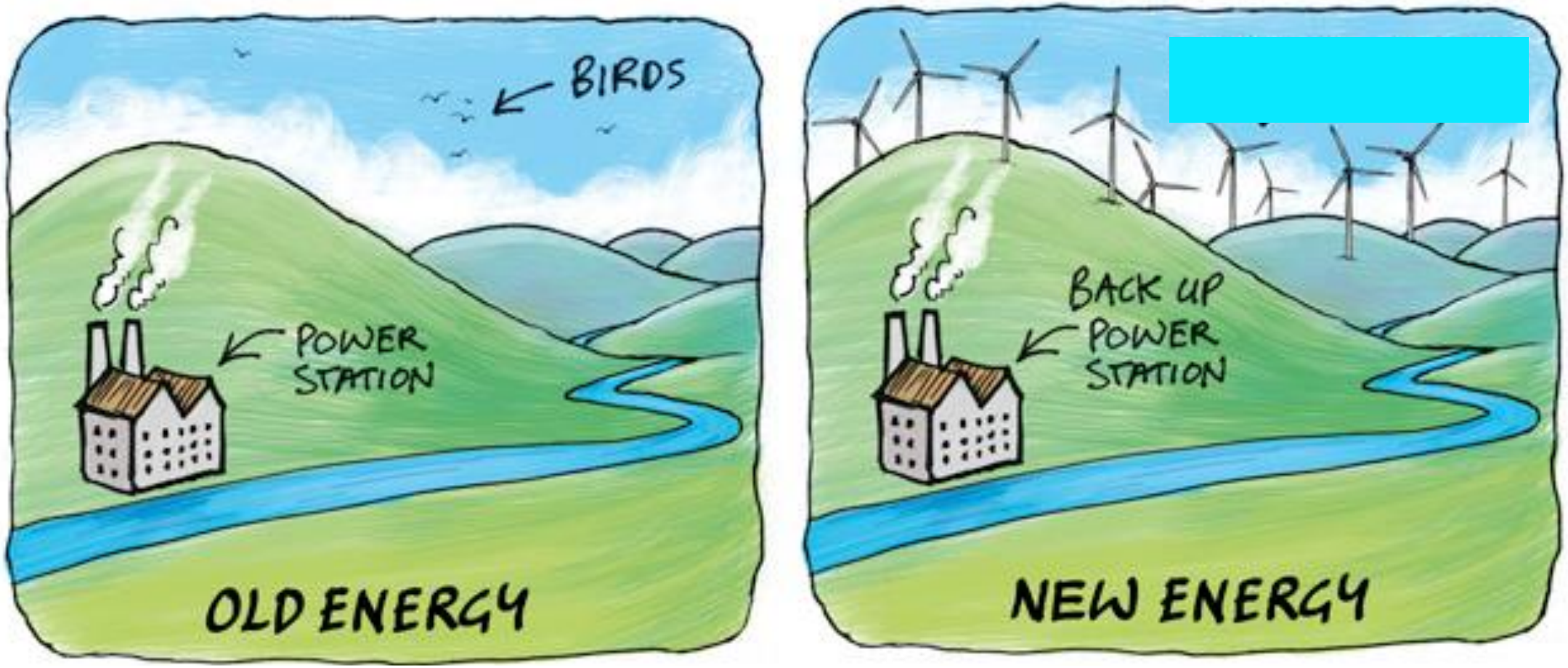
Support for renewable electricity production in Germany

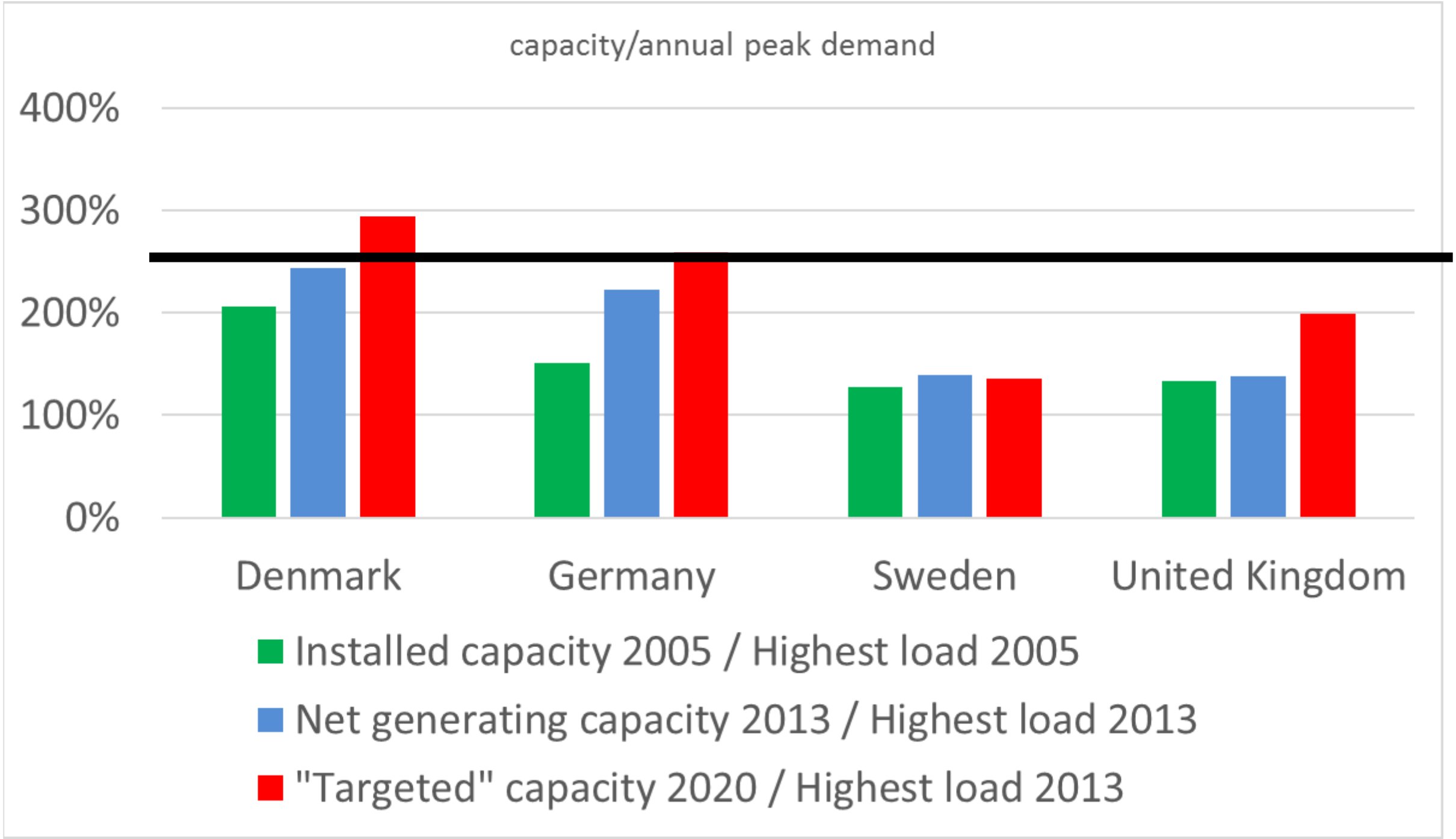


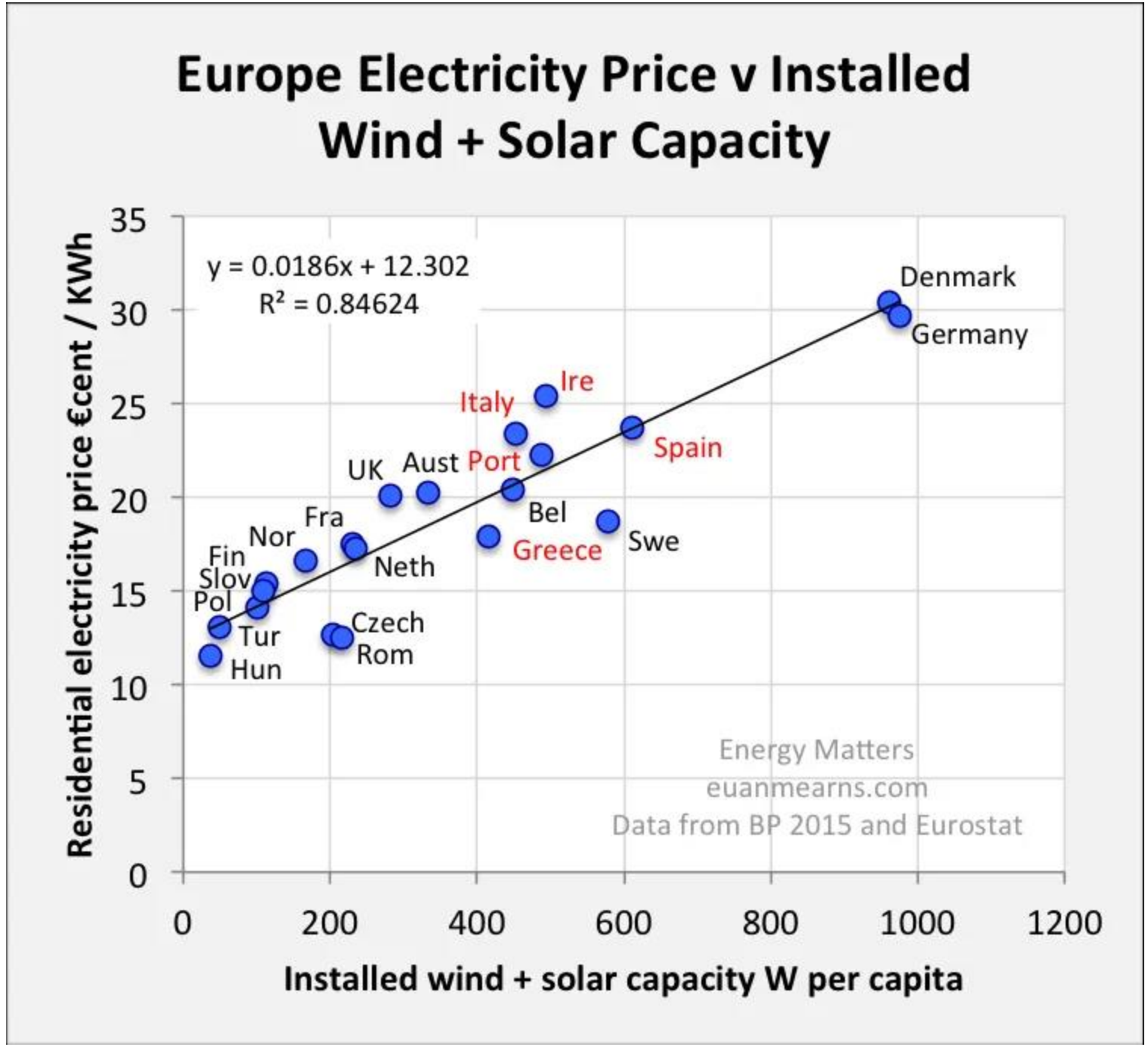
Germans spent EUR 34bn on measures to reduce emissions last year, yet the country was set to fall far short of a range of climate-related goals by 2020, the report said.

Source: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: Development of renewable energy sources in Germany

0.9 MW-rule

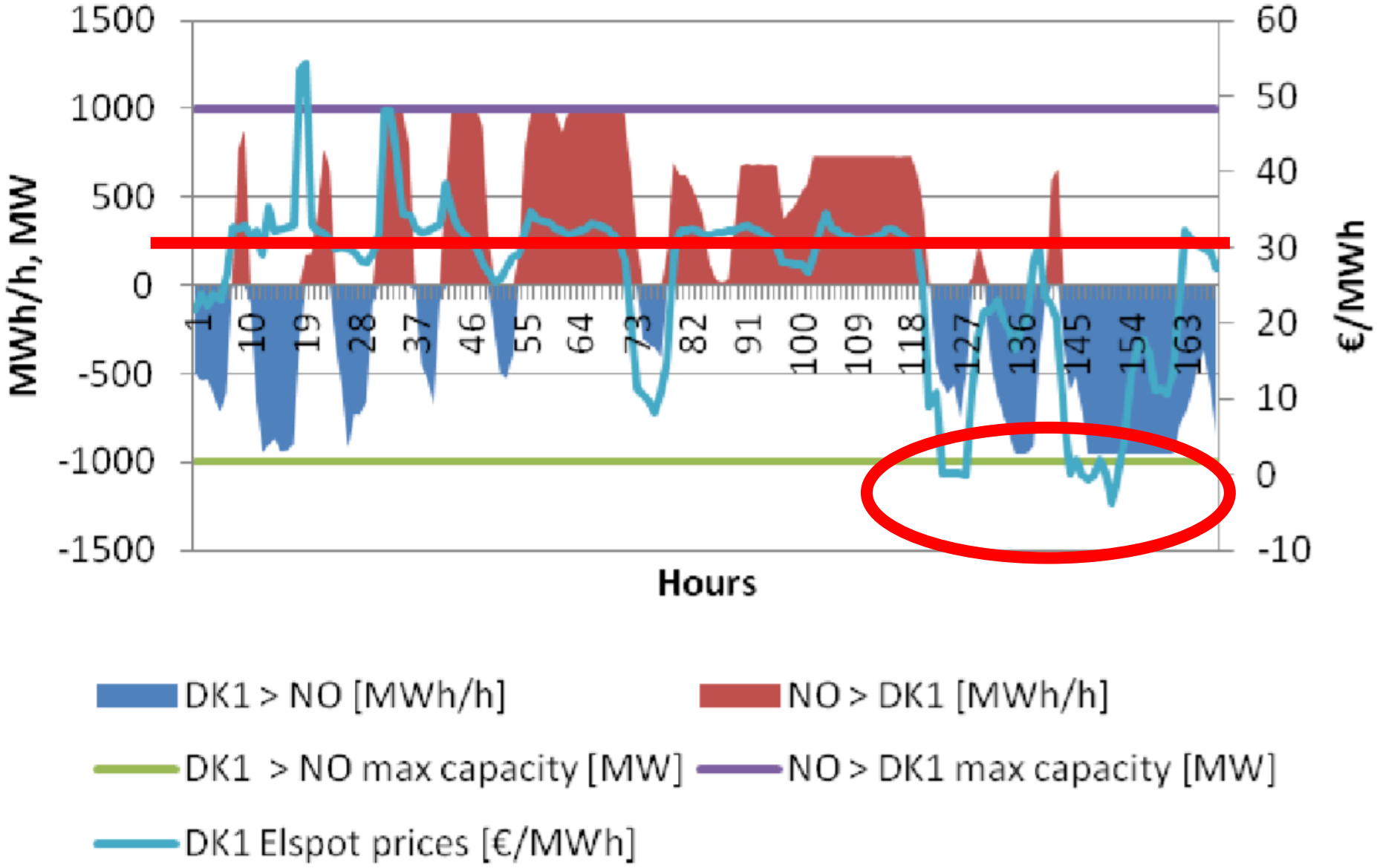

BIRDS
POWER STATION
OLD ENERGY
BACK UP POWER STATION
NEW ENERGY


capacity/annual peak demand
400%
300%
200%
100%
0%
Denmark
Germany
Sweden
United Kingdom
Installed capacity 2005 / Highest load 2005
Net generating capacity 2013 / Highest load 2013
"Targeted" capacity 2020 / Highest load 2013


Europe Electricity Price v Installed Wind + Solar Capacity
y = 0.0186x + 12.302
R² = 0.84624
Residential electricity price €cent / KWh
Installed wind + solar capacity W per capita
0
5
10
15
20
25
30
35
0
200
400
600
800
1000
1200
Denmark
Germany
Ire
Italy
Spain
Port
UK
Aust
Bel
Fra
Nor
Swe
Greece
Fin
Neth
Slov
Pol
Czech
Tur
Rom
Hun
Energy Matters
euanmearns.com
Data from BP 2015 and Eurostat

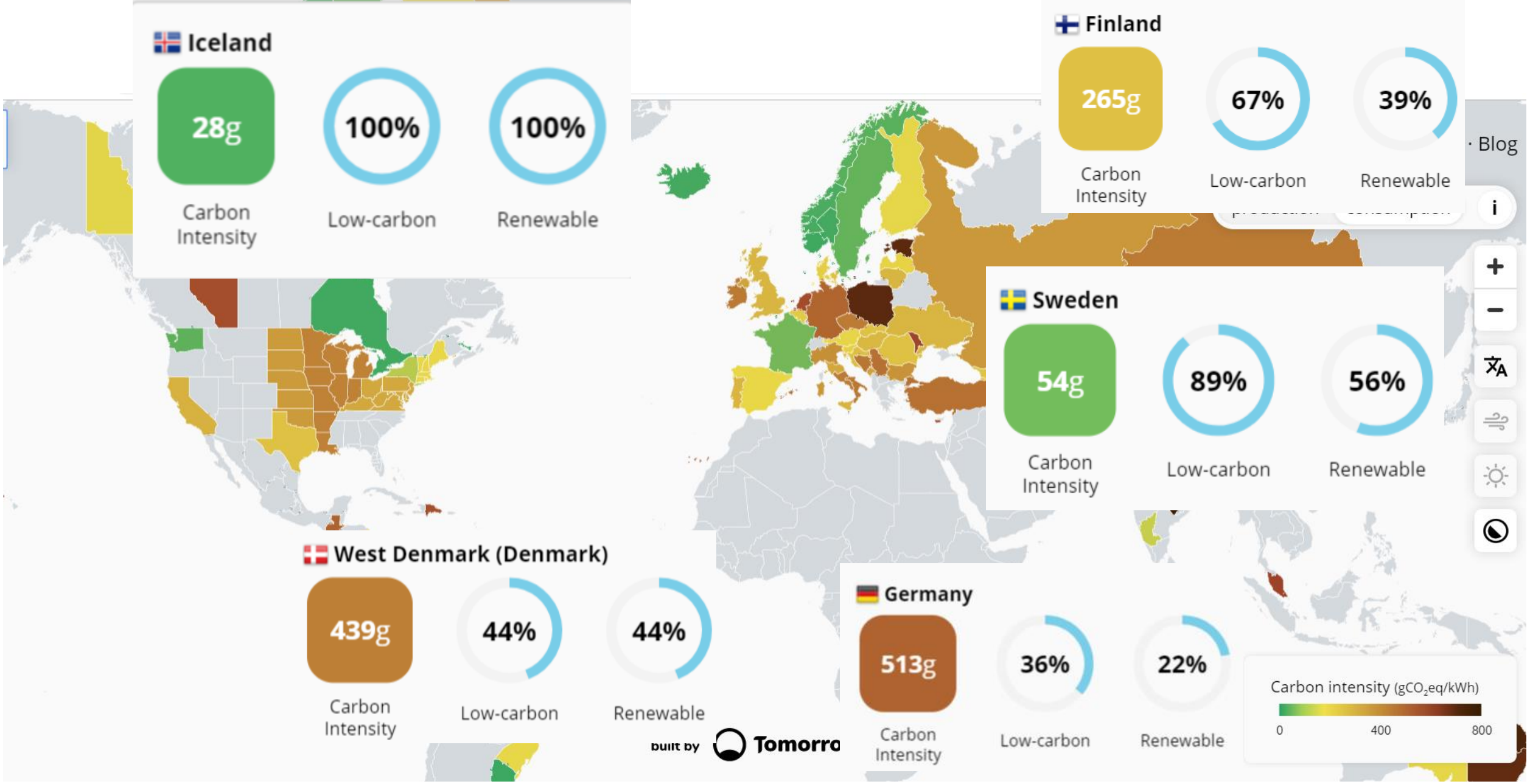

Dunkelflaute

Figure 6 Electricity trade between the Denmark (Jutland, DK1) and Norway NO, and the DK1 Elspot prices in 11. 17 August, 2014 (see online version for colours)



Source: NordPool Spot

Sweden and the climate issue


Iceland
28g
Carbon Intensity
100%
Low-carbon
100%
Renewable
Finland
265g
Carbon Intensity
67%
Low-carbon
39%
Renewable
· Blog
Sweden
54g
Carbon Intensity
89%
Low-carbon
56%
Renewable
West Denmark (Denmark)
439g
Carbon Intensity
44%
Low-carbon
44%
Renewable
Germany
513g
Carbon Intensity
36%
Low-carbon
22%
Renewable
Carbon intensity (gCO2eq/kWh)
0
400
800
built by Tomorro

Søren Dupont Kristensen Direktør, Systemudvikling og Elmarked @ Energinet.dk 17d

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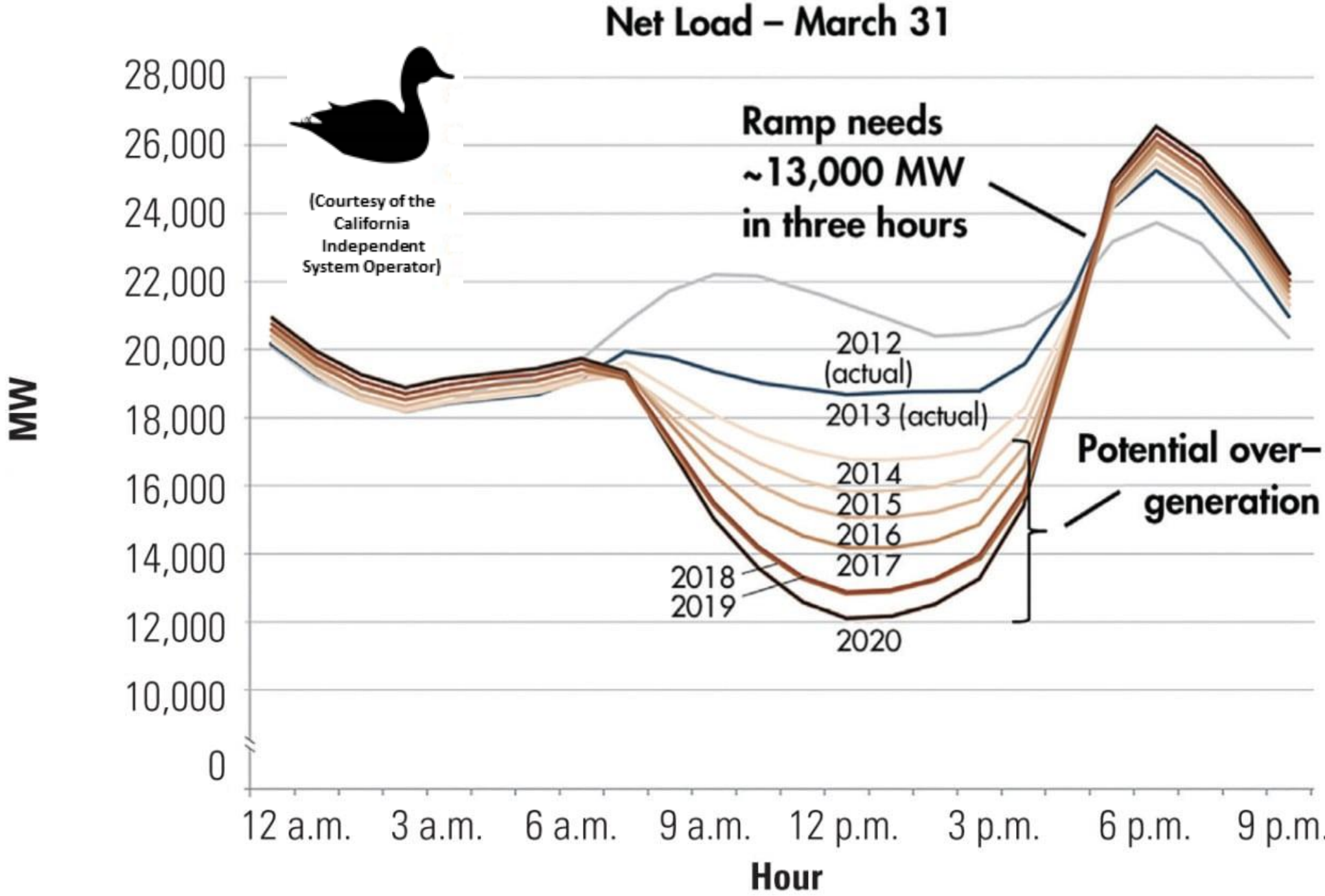
Thanks to more wind power and

Large imports of electricity from Norway and Sweden

CO2 emissions from Danish power consumption were reduced by a third in 2015,

1800 MW coal power decommissioned

- Kristiina and Tahkoluoto, 475 MW in total, coal-fired, closed in 2015
- Kristiina and Vaskiluoto, 365 MW in total, oil-fired, closed in 2015
- Inkoo, 1000 MW in total, coal-fired, one unit closed in 2013, last three units closed in 2014


Net Load – March 31
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
0
MW
(Courtesy of the California Independent System Operator)
Ramp needs ~13,000 MW in three hours
2012 (actual)
2013 (actual)
2014
2015
2016
2017
2018
2019
2020
Potential over–generation
12 a.m.
3 a.m.
6 a.m.
9 a.m.
12 p.m.
3 p.m.
6 p.m.
9 p.m.
Hour

The larger picture

Asia

Sep 19th 2019 edition ›

Banyan

Are dictatorships better than democracies at fighting climate change?


PBOY

building – development

– some issues

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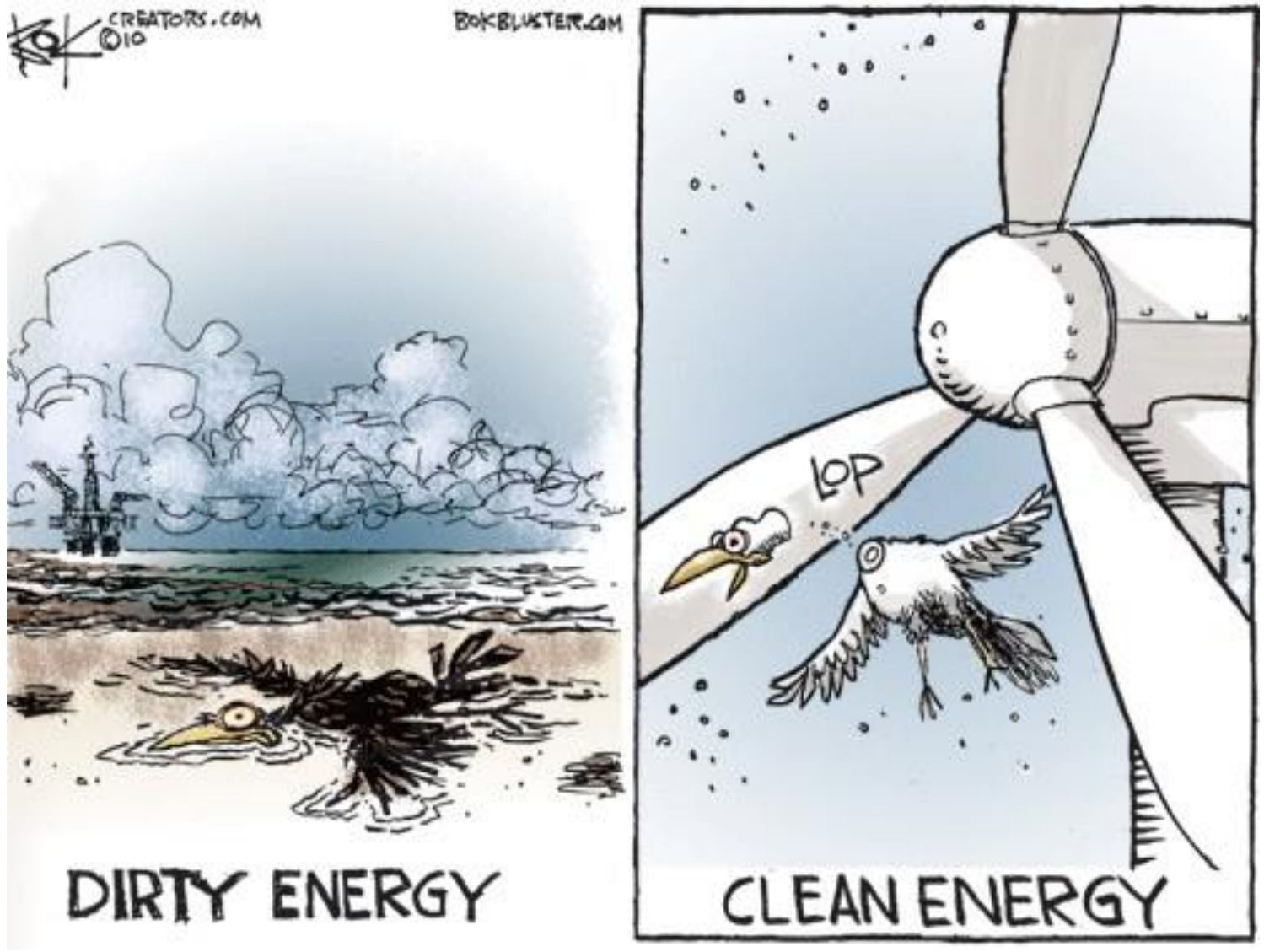
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LOP
DIRTY ENERGY
CLEAN ENERGY

High-tension power lines and wind turbines are seen at dawn near a coal-fired power plant at Haemelerwald Sehnde, Germany | Alexander Koerner/Getty Images

RAW POWER

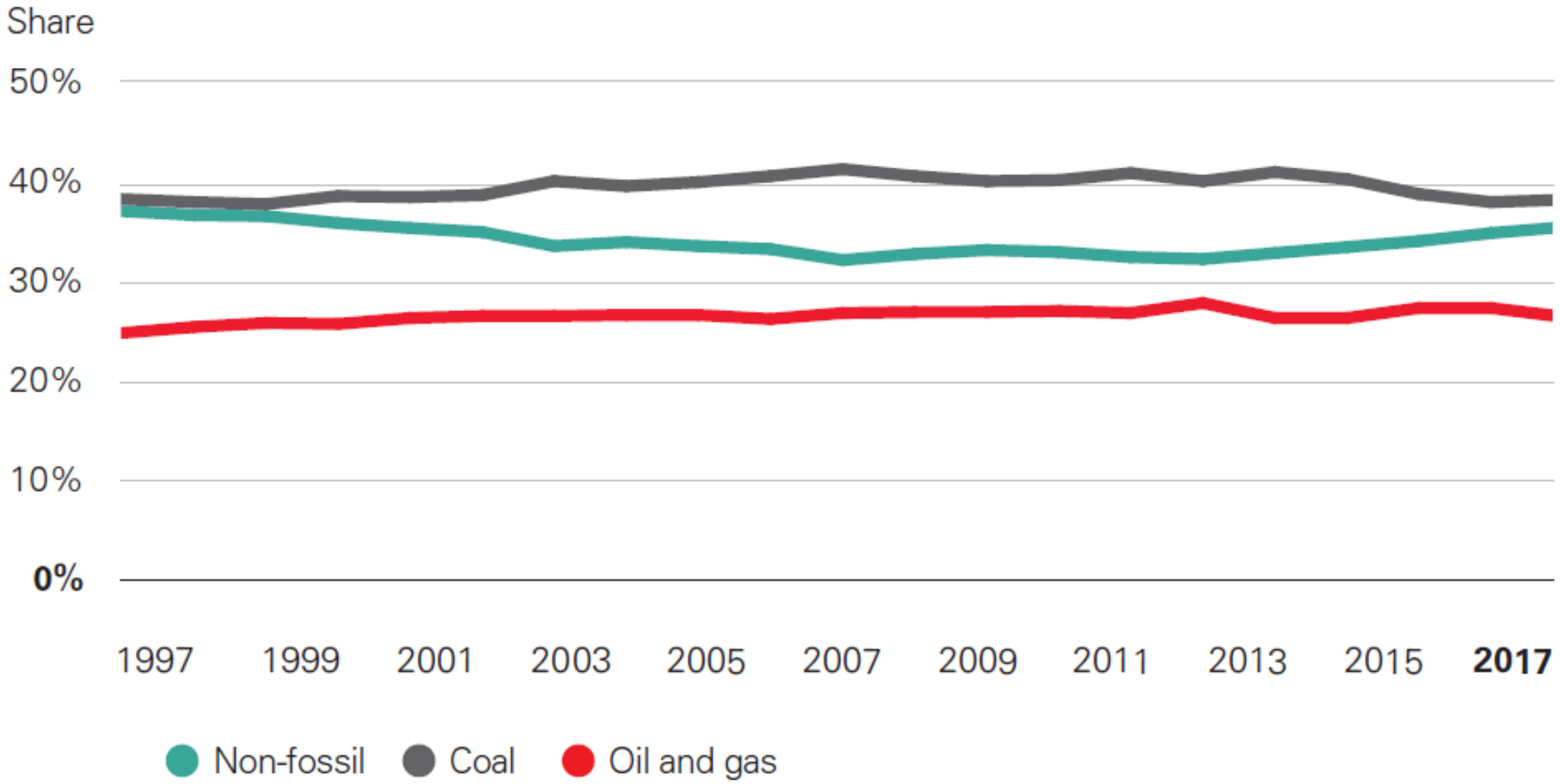
Going electric, but not in my backyard

Europe needs thousands of kilometers of new power lines for green energy — but local resistance is strong.


JA
zur Energiewende
NEIN
zur Stromtrasse

Thank You!

Fuel shares in power generation



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