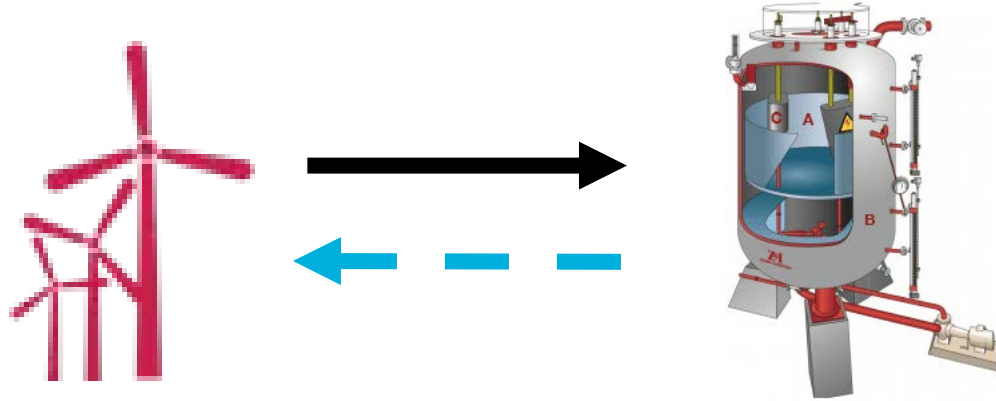


# Wind\* -to-Industry



Jilles van den Beukel,  
13 Juni 2018

# Climate agreement

Government goal carbon reduction (PBL update 2018): 48,7 Mton

**Tabel 1. Ten opzichte van het Regeerakkoord herziene indicatieve sectorale verdeling van de opgaven en de corresponderende emissies in 2030. (i.r.t. het Regeerakkoord)**

Sector	Indicatieve sectorverdeling Regeerakkoord <sup>1</sup>	Herziene indicatieve sectorale verdeling t.b.v. Klimaatakkoord <sup>1</sup>	Emissies 2030 na uitvoering Klimaatakkoord
Industrie <sup>2</sup>	22	14,3	35,7
Mobiliteit	3,5	7,3	25,0
Gebouwde omgeving	7	3,4	15,3
Elektriciteit <sup>2</sup>	20	20,2	12,4
Landbouw & landgebruik	3,5 <sup>3</sup>	3,5 <sup>3</sup>	22,2 <sup>4</sup>
Totaal	56 <sup>3</sup>	48,7 <sup>3</sup>	110,6

- Significant reduction challenge for both industry and electricity
- Electricity sector mainly depends on Offshore Wind
- Industry, besides CCS, mainly depends on electrification

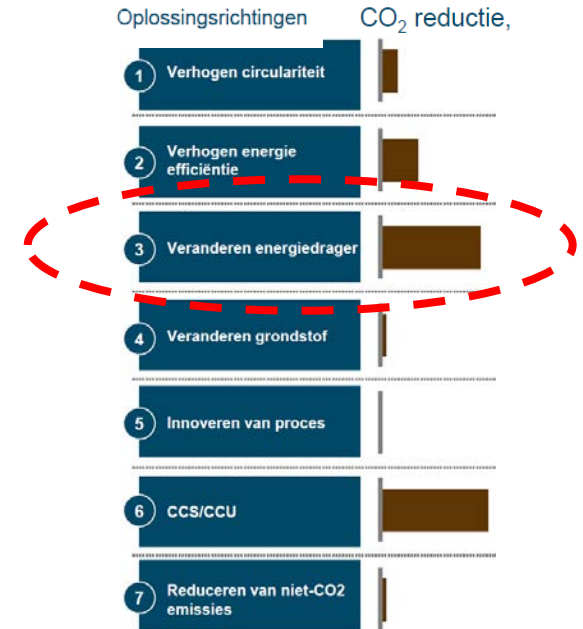
# Electrification Industry Significant and Attractive

## Electrification options industry significant (2030 + ~ 5000 MW)

- Heat pumps
- Elektric Boilers/Hybrid systems
- Electric cookers
- *Green hydrogen with electrolysis*

## Electrification options industry interesting:

- Potential CO<sub>2</sub> reduction 2030 of ≥ 5,4 Mton\*
- Strong growth in electricity demand (+ 15-30 TWh)
- Mainly coastal locations (Rijnmond, Moerdijk, Zeeland, Delfzijl)
- Partially flexible (~ 2750 MW)



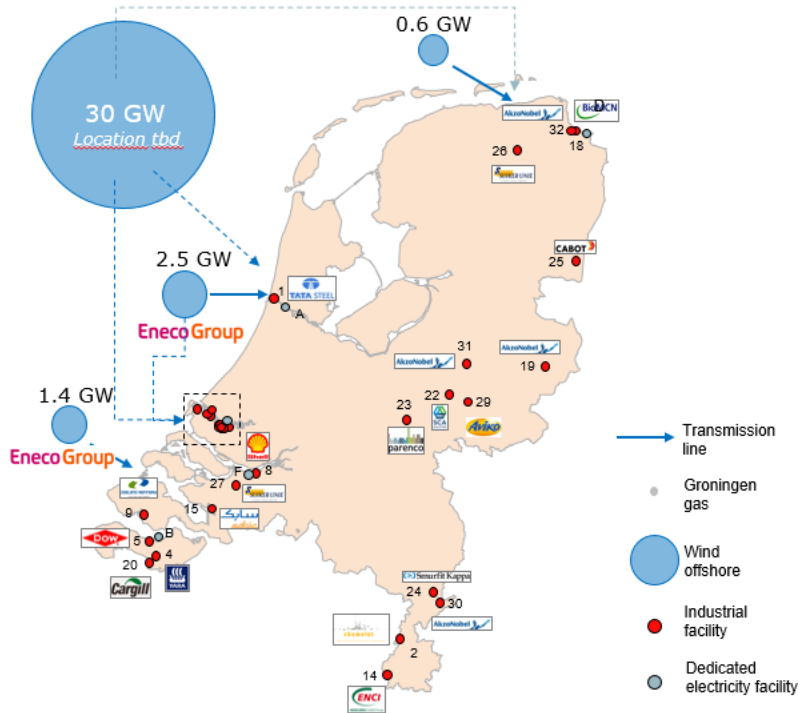
\*Potential according PBL: 5,4 Mton

# Electrification industry depends on emission factor

	Electrification linked to grid*	Electrification linked to offshore wind
<b>Direct effect</b> Reduction of emissions by replacement of gas by electric boiler and replacement of gas for more efficient alternative (heat pumps)	-5,4	-5,4
<b>Indirect effect</b> Increased emissions from the electricity sector by filling in additional demand from fossil-fired plants	+7,8	0
<b>Further defined effect</b> Hybrid electrification industry (boilers / heat pumps) as flexibility option to use sustainably generated electricity that would otherwise be lost by curtailment	-?	
<b>Total effect</b>	+2,4	-5,4

Result improves if the electrification comes from wind and sun with emission factor 'zero'

# Offshore Wind Significant & Attractive



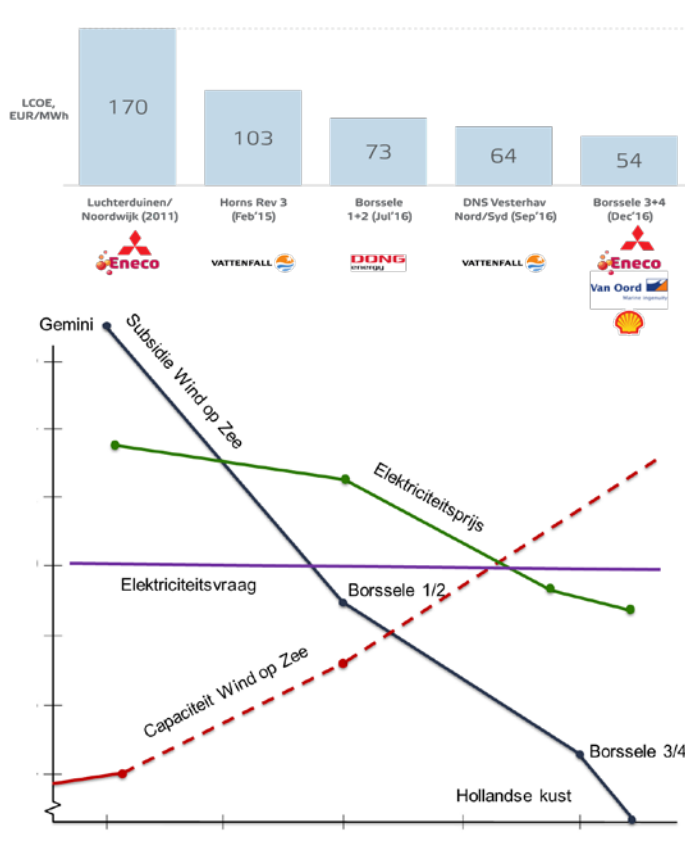
Potential Offshore wind **significant**  
(2030 + 10-14 GW)

- Favourable location Northsea
- Potential >2030 significant

Offshore wind as an **attractive**  
reduction option for e-sector:

- Cost efficient (Eur/ton)
- Spatial possible

# Challenge offshore wind



## Circumstances new offshore windpark:

- Constant electricity demand
- Overcapacity of the electricity production park
- (Possibly) no more subsidy

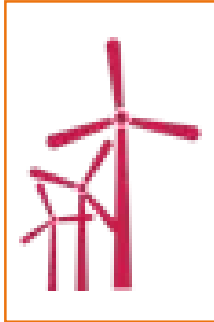
→ Uncertain cash flow (electricity price) and therefore increased risks!

These increased risks result in no or expensive financing. As a result, investments in offshore wind are not forthcoming.

# The solution: wind-to-industry

Simultaneous production and demand; long term link

## Supply



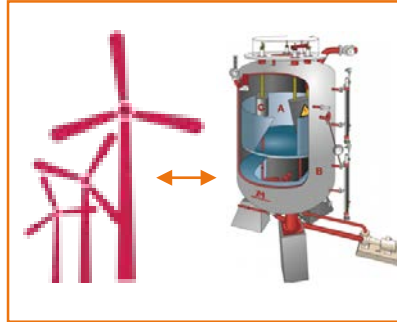
Offshore wind  
without 'guarantees'

## Demand



Electrification industry  
incl opex

## Supply & Demand



Wind2industry

## Advantages wind-to-industry

1. Lower (financing) costs offshore wind:

- Growth in electricity demand keeps pace with offshore production growth
- Certainty about the purchase of electricity production in the wind farm;

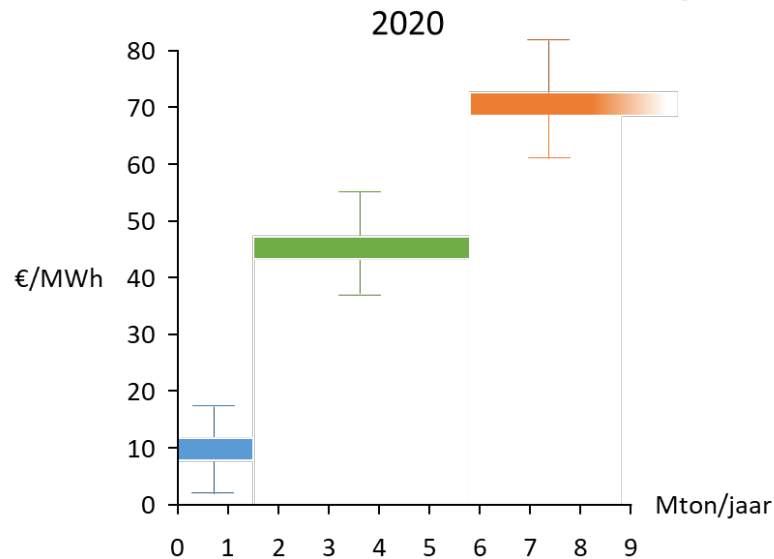
2. Electrification leads to a significant CO<sub>2</sub> reduction industry

3. Considerable flexibility option for the total energy system

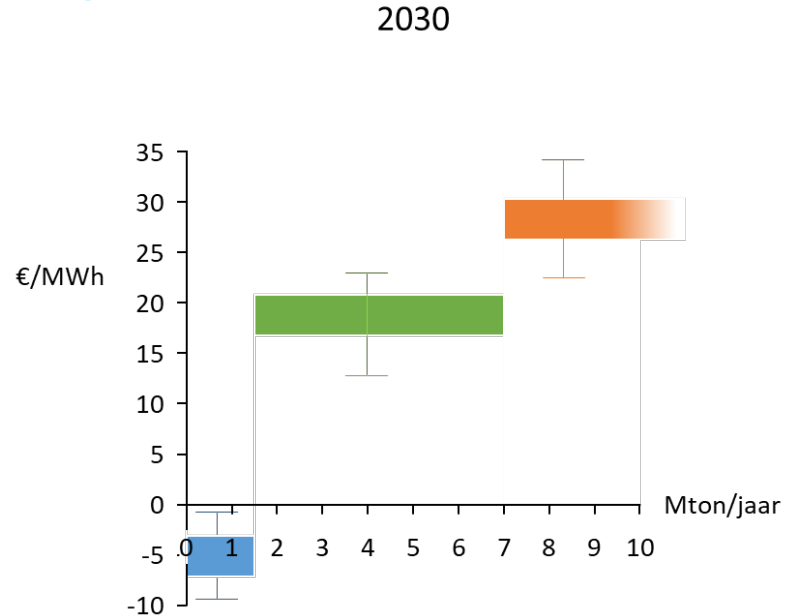
→ **CO<sub>2</sub> reduction at the lowest social costs**

# Electrification within industry is not viable in current situation

“Unprofitable top” (€/MWh)



warmtepomp electrode boiler electrolyzer

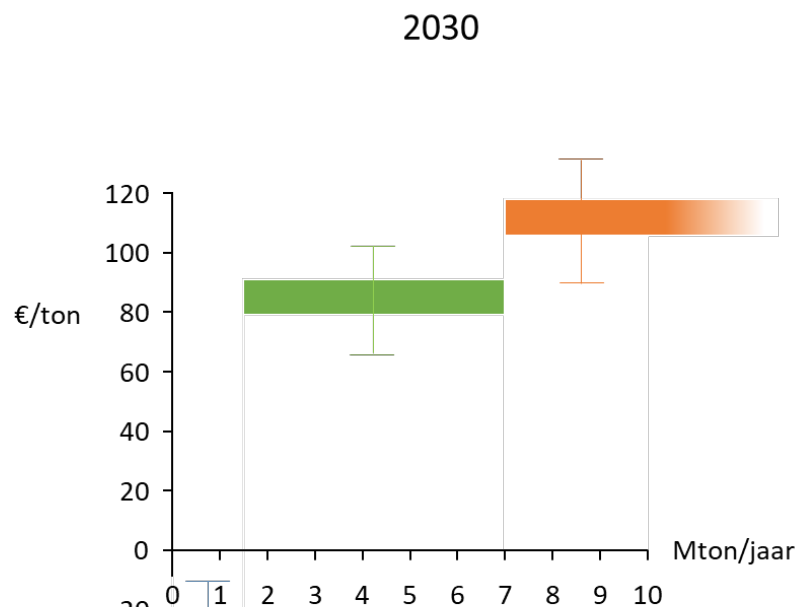
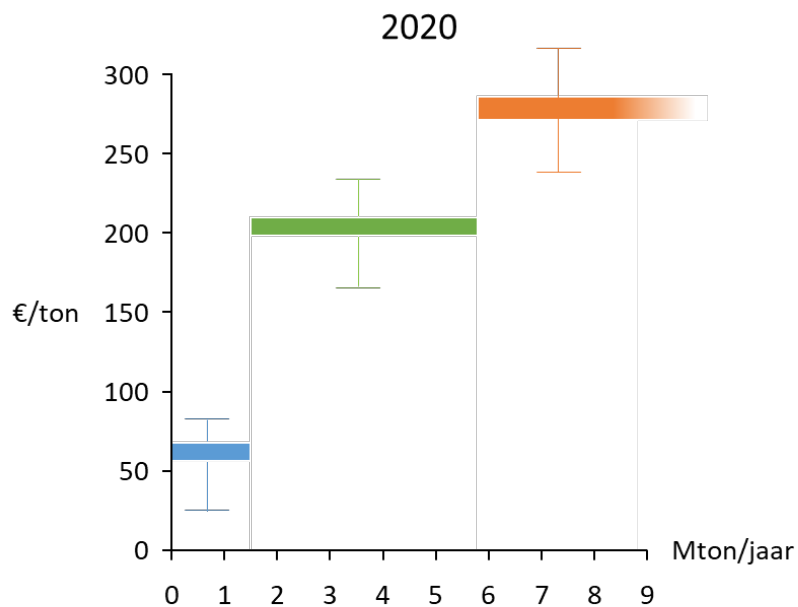


warmtepomp electrode boiler electrolyzer

When the wind blows (4300 hours per year) based on energy prices NEV 2017



# Cost of electrification per avoided ton of CO<sub>2</sub>



warmtepomp electrode boiler electrolyzer

warmtepomp electrode boiler electrolyzer

*When the wind blows (4300 hours per year) based on energy prices NEV 2017*

# Therefore, stimulation of supply and demand is necessary

**Possible instruments** for stimulating the coupling of wind and electrification (in the development phase)

1. Entity: Windpark and P2X installation form one entity;
2. Tender: Windpark is linked to P2X via a coupled and simultaneous tender;
3. Market: P2X installation buys GvOs from wind farms

**Conditions** for each of the different stimulation routes:

- Used electricity must be demonstrably generated CO<sub>2</sub> free
- Demonstrable link between sustainable generation and electrification demand
- Sufficient and smart incentives for innovation to reduce generation and electrification costs
- Solution must consider business processes



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