

# Nuclear safety



Nuclear safety is the protection of people and environment from harmful effects of a radioactive release and ionizing radiation.

At EPZ we do that by continuously improving our technology, organisation and culture.

## Last Minute Risk Analysis (LMRA)

### Look around and ask yourself:

1. Am I working at the intended equipment?
2. Do I know and understand the job I have to do?
3. Is the work area free of danger for me and the installation?
4. Do I wear the proper Protective Personal Equipment (PPE) required?
5. Is my work area clean and without tripping hazards?
6. Do I know the escape route and it is it free?
7. Is the work procedure known to me and are work permits in order?
8. Is the installation (electrically) secured?
9. Do I have the right (approved) tools?
10. Is communication with colleagues necessary and possible?

## Pre-job briefing (PJB)

### Five key questions:

1. Have we done this job before?
2. What are the critical steps?
3. What can go wrong?
4. What is the worst thing that could happen?
5. What are our preventive measures?

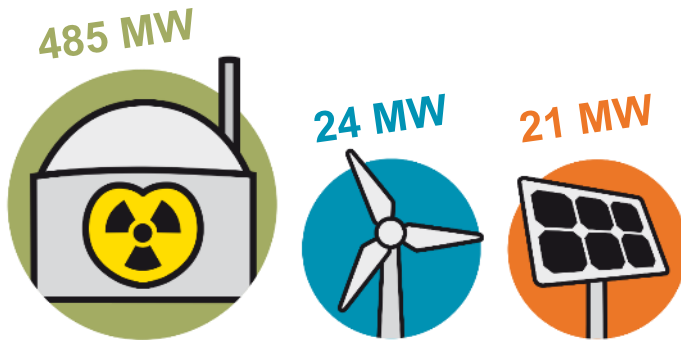


# N.V. EPZ Electricity without CO2



- Safe
- Available
- Affordable

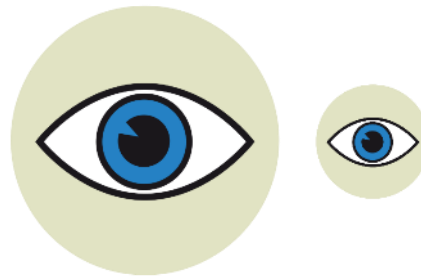
## Production Borssele:



Nuclear-, wind- + solar energy

**530 MW – 4.000.000 MWh**  
Without CO<sub>2</sub>

## Shareholders:



**70%** PZEM Energy B.V.

**30%** Energy Resources Holding B.V.

## Equity:



**100% equity no debt**

# Finding the optimum





Follow us on our journey to the future





Follow us on our journey to the future

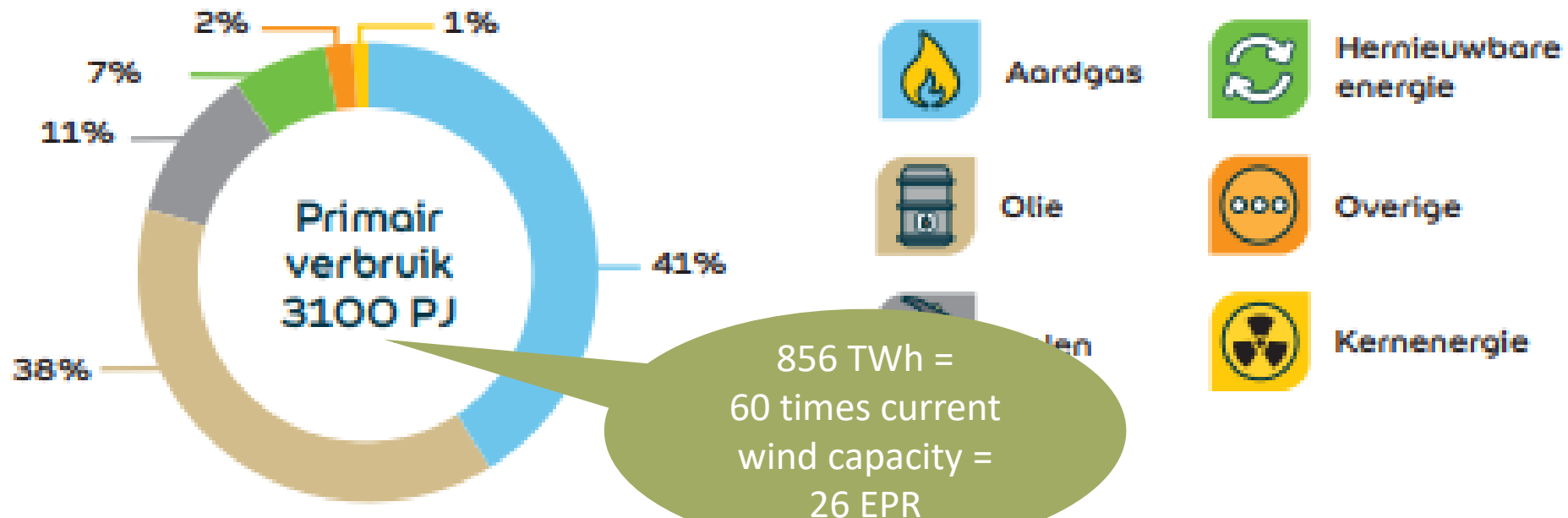


- Dutch targets
- EPZ strategy
- Realistic?



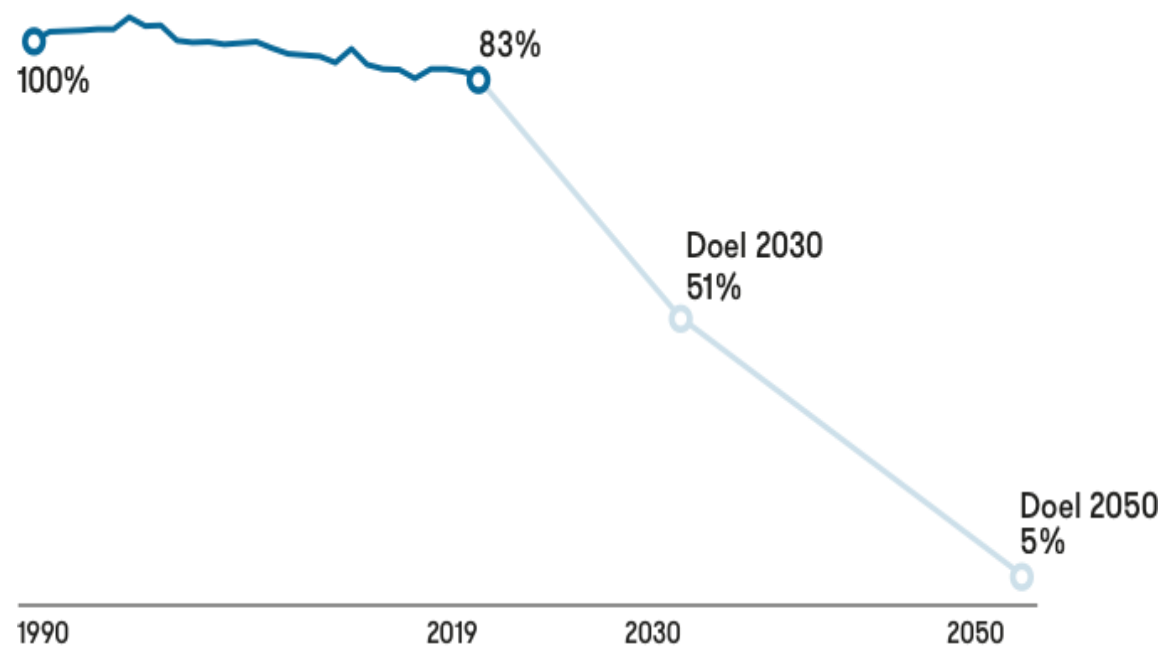
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Hoeveel energie verbruikt Nederland in totaal en uit welke bronnen komt dit?

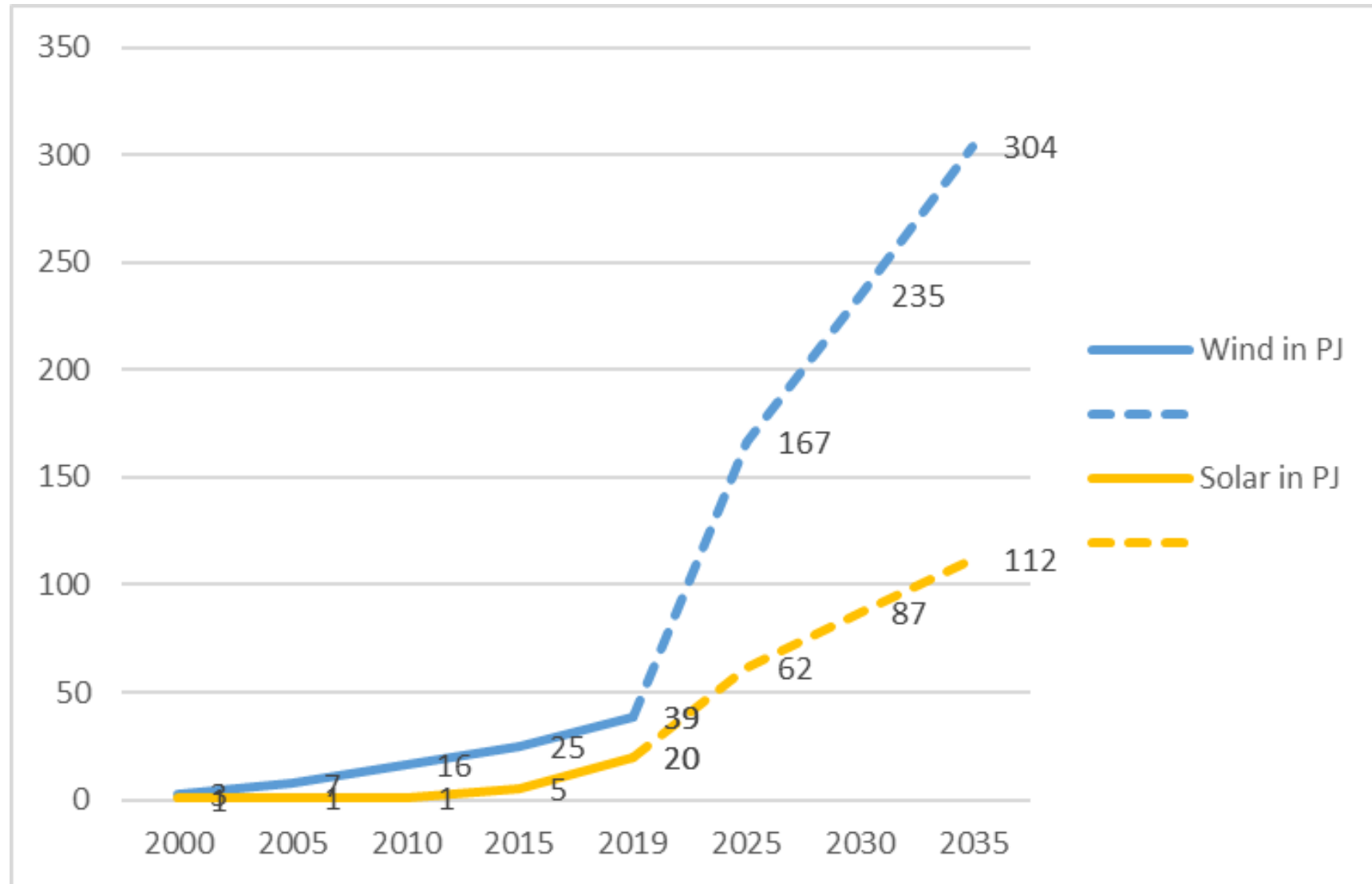


Met 1 PJ kan je een stad als Tilburg een jaar lang van elektriciteit voorzien.

# Dutch sustainability targets in % of the 1990 CO2 emissions

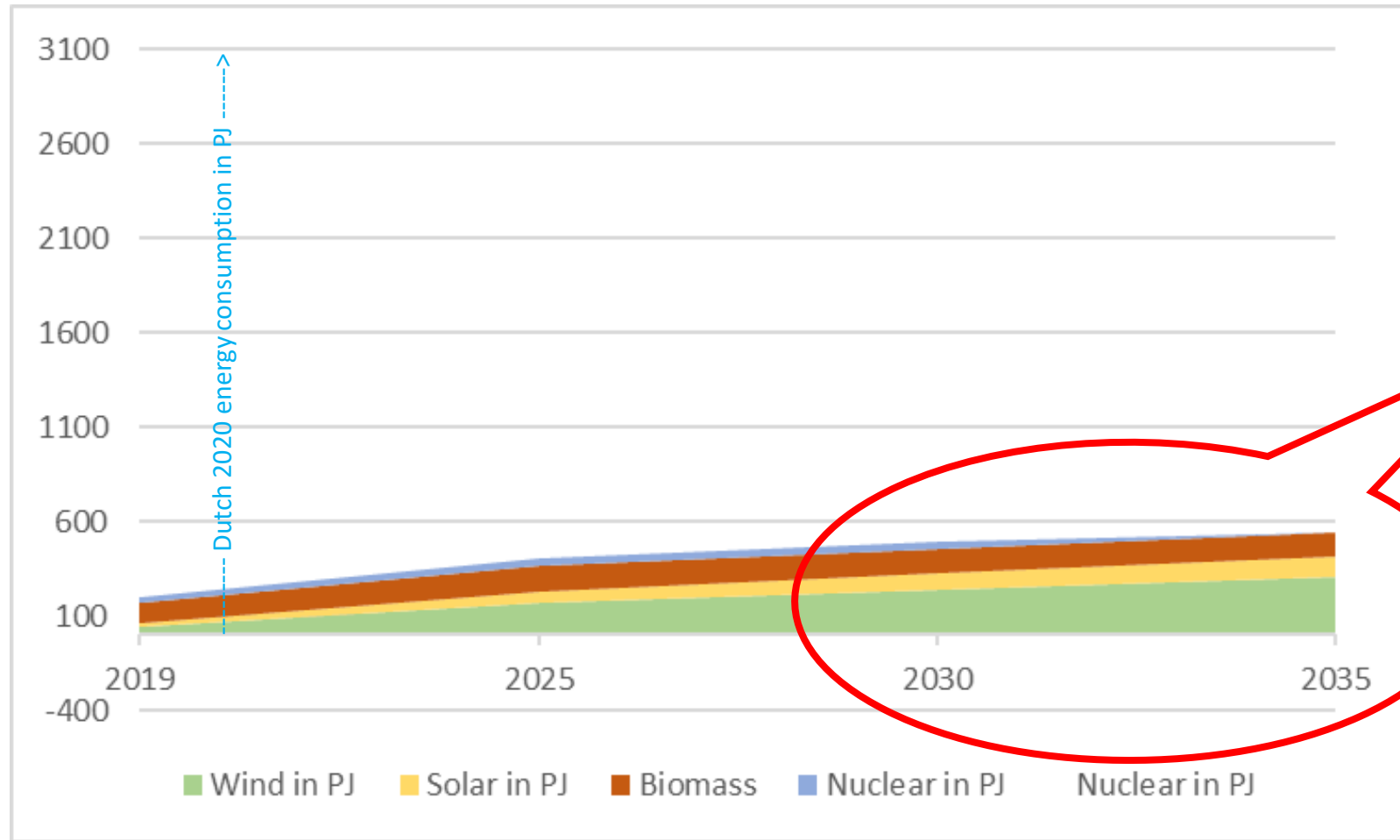


# Dutch solar and wind actuals and targets





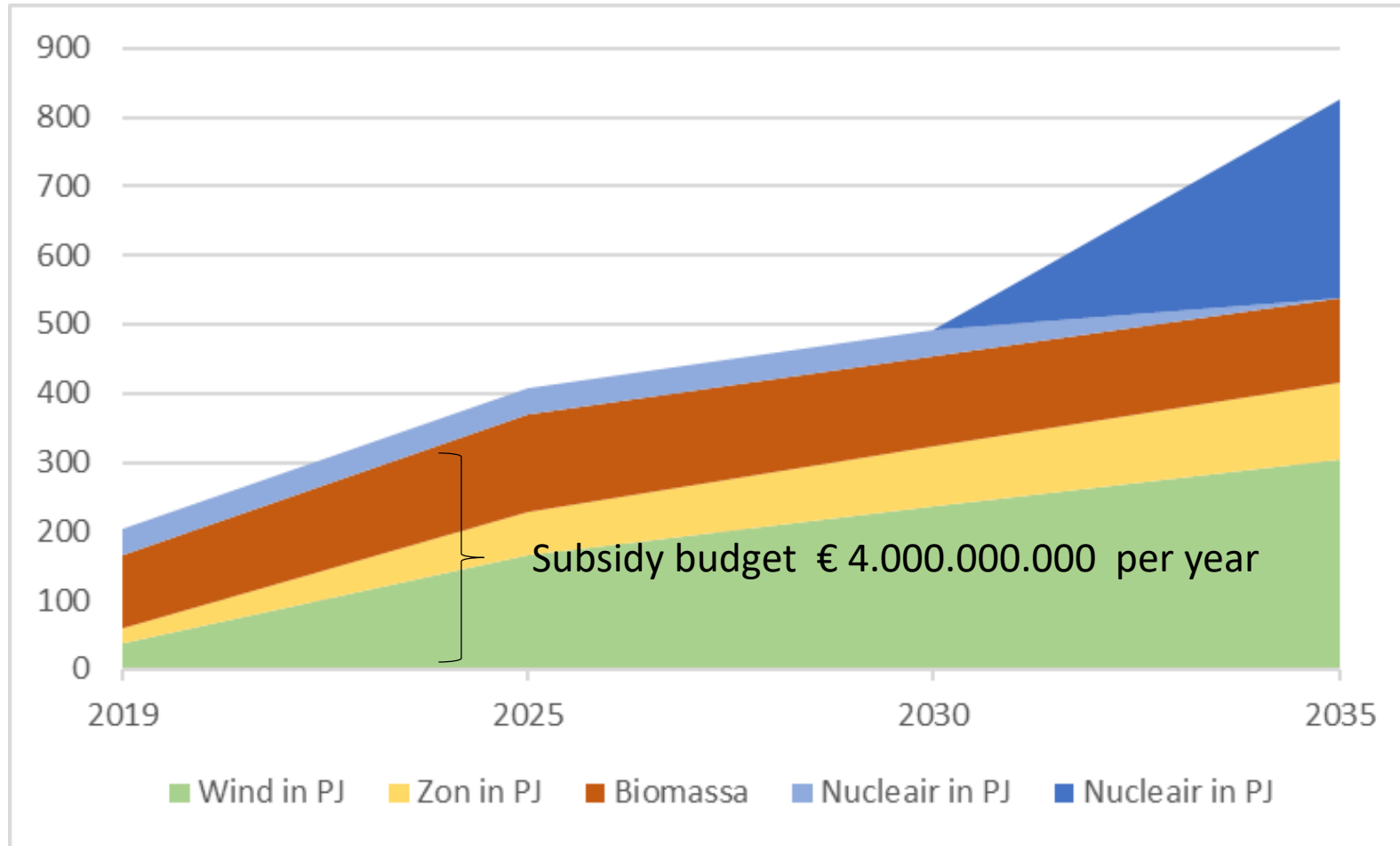
# Current governmental policy



results in 2035 in 500 PJ (18% of the energy consumption) CO2 free energy



# Impact new nuclear



2 new nuclear power plants means 288 PJ extra (from 18% to 28% of the energy consumption)

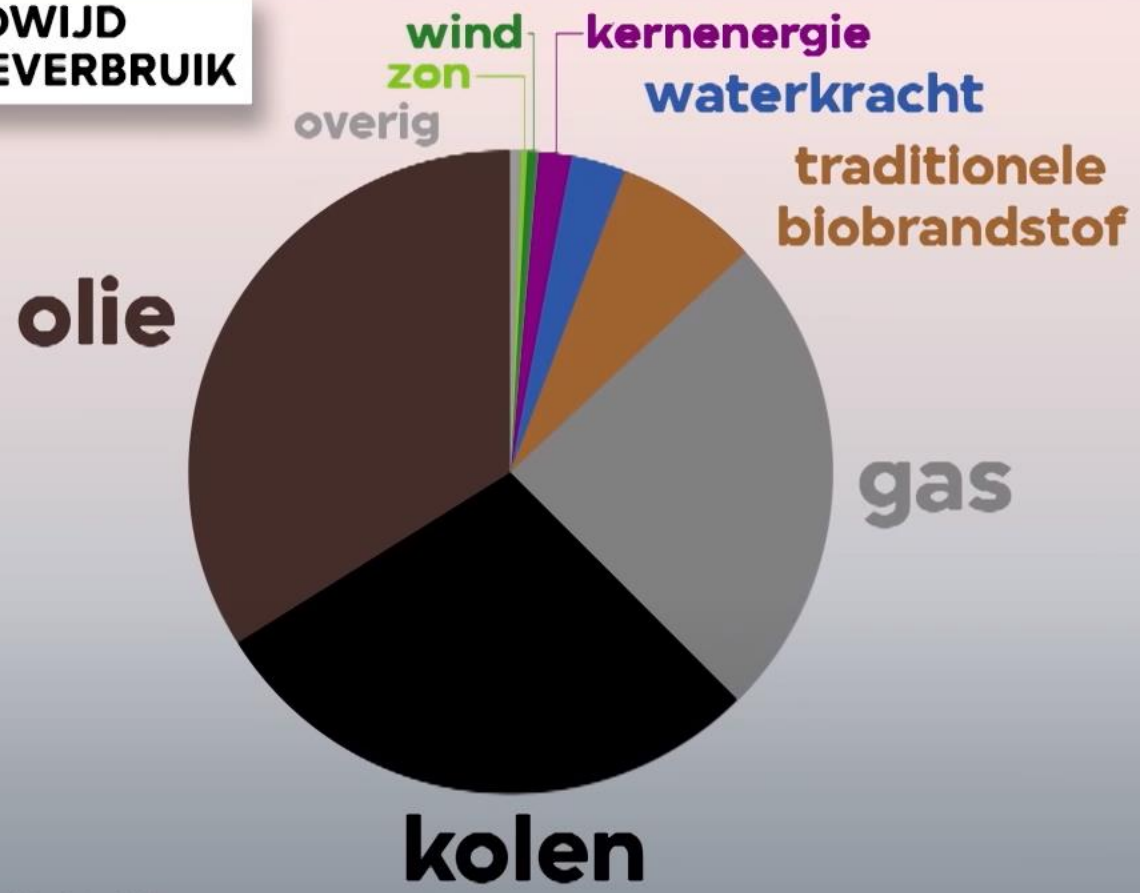
- 11.2018 Arjen Lubach:  
(satirical tv show)

‘Nuclear is a realistic alternative’



The video player shows a man in a suit (Arjen Lubach) speaking. An inset image shows a nuclear power plant with the text 'KERNENERGIE' overlaid. A subtitle reads: 'Now we need to talk about, hold on, Nuclear power'. The video player interface includes a progress bar at 0:08 / 19:15, a play button, and various control icons. Below the video, there is a description: 'VPRO is a Dutch public broadcast service. Wikipedia'. The video title is '#ZML #ZondagMetLubach #NP03 Nuclear Energy - Zondag met Lubach (S09)'. It has 2,384,808 views and was uploaded on Nov 4, 2018. Engagement icons show 36K likes, 1.4K dislikes, and options for share, save, and more.

**WERELDWIJD  
ENERGIEVERBRUIK**



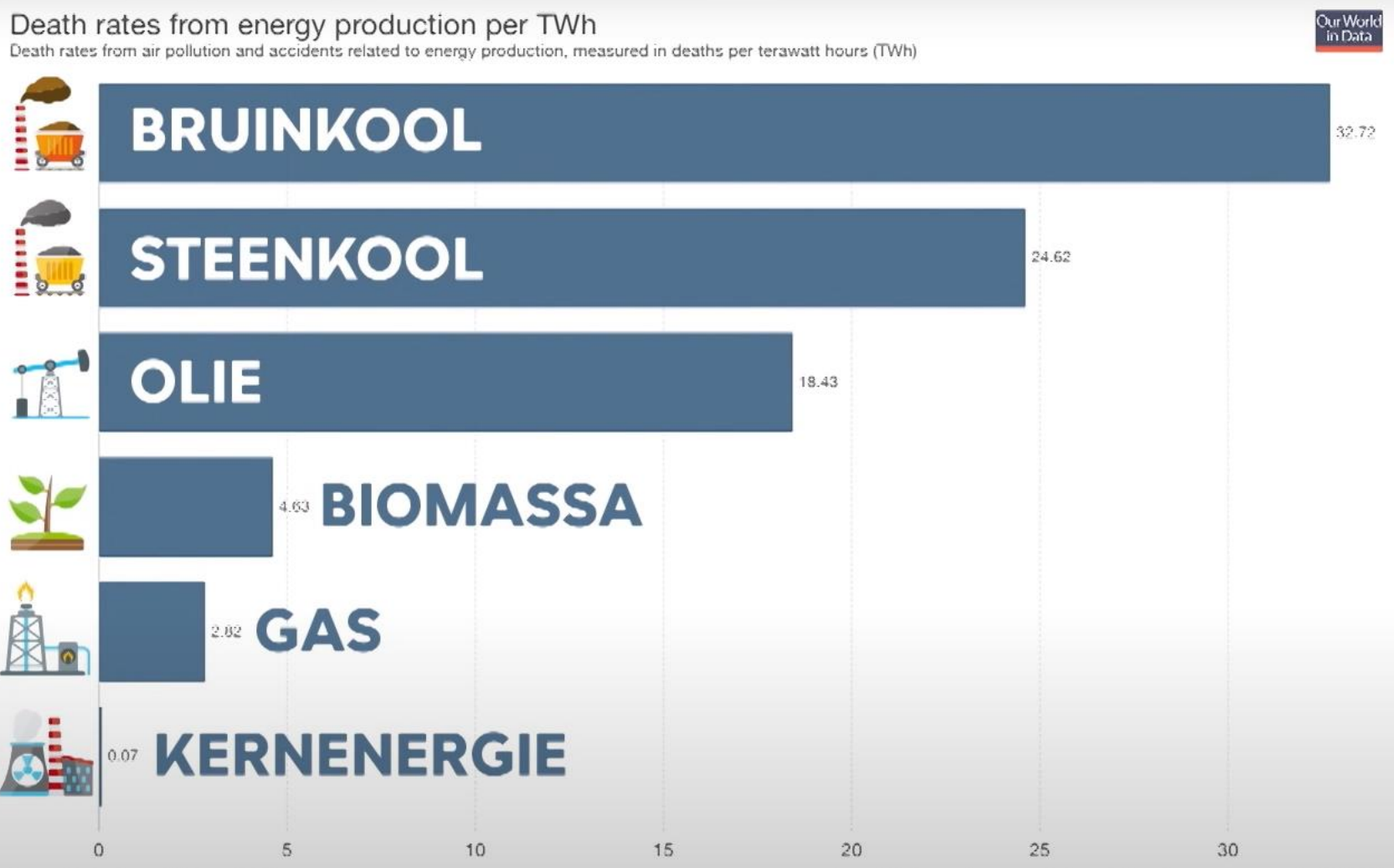
bron: Our World in Data 2016

By far the most is taken up by oil, coal and gas,



but that is going too slowly. Luckily, there is another way to produce energy without producing CO<sub>2</sub>, namely:





Source: Markandya and Wilkinson (2007) [OurWorldInData.org/energy-production-and-changing-energy-sources/](https://OurWorldInData.org/energy-production-and-changing-energy-sources/) • CC BY-SA  
Note: Figures include deaths resulting from accidents in energy production and deaths related to air pollution impacts. Deaths related to air pollution are dominant, typically accounting for greater than 99% of the total.

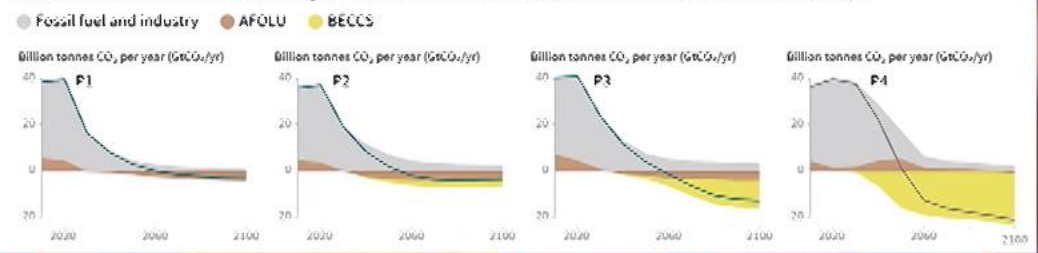
Here you can see how deadly the most common forms of energy are.

ipcc  
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE  
WMO UNEP

# Global Warming of 1.5°C

An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

Breakdown of contributions to global net CO<sub>2</sub> emissions in four illustrative model pathways



and in the 4 most important scenarios there is a need for more nuclear energy.



Since the nuclear waste goes underground instead of in the atmosphere, has the use of nuclear power according to NASA already prevented 2 million deaths



... look we are not principally against it, it is very pragmatic, bron: NOS-NTR Nieuwsuur 26-10-18

# Our journey

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## En, worden de doelen voor 2020 en 2030 gehaald?

### Doelen voor 2020

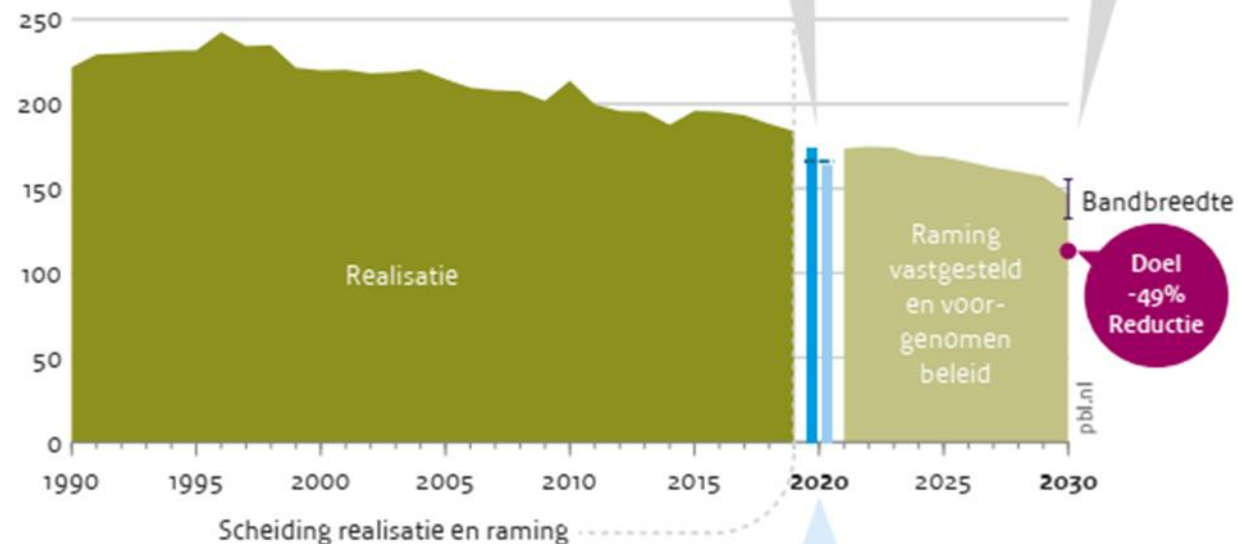
- Vermindering uitstoot broeikasgassen met 25% t.o.v. 1990
- Hernieuwbare energie maakt 14% uit van het totaal
- 482 petajoule energiebesparing voor de periode 2014-2020

### Doelen voor 2030

- Vermindering uitstoot broeikasgassen met 49% t.o.v. 1990
- Hernieuwbare energie maakt 27% uit van het totaal
- 924 petajoule energiebesparing voor de periode 2021-2030

Emissie broeikasgassen exclusief landgebruik in megaton CO<sub>2</sub>-equivalenten

Bron: Emissieregistratie (realisatie); KEV-raming 2020



### Inschatting 2020

- Scenario Hoog: economische gevolgen corona beperkt, koude winter, meer elektriciteitsproductie
- Scenario Laag: economische gevolgen corona aanzienlijk, milde winter, minder elektriciteitsproductie
- Urgenda-doelstelling

### Aanvullende info

De KEV is een studie van PBL, CBS, TNO EnergieTransitie en RIVM, met bijdragen van RVO.nl  
 Voor meer informatie over de KEV: [www.pbl.nl/kev](http://www.pbl.nl/kev)

### Hoofdconclusies:

#### Uitstoot broeikasgassen:

- 2020: **MOGELIJK**: Maar ook met strenge coronamaatregelen is kans op halen Urgenda-doel klein
- 2030: **NEE**: Forse extra inspanning nodig om 49% reductie te bereiken

#### Hernieuwbare energie:

- 2020: **MOGELIJK**: Administratieve verrekening met Denemarken mogelijk onvoldoende
- 2030: **NEE**: Vanwege te laag groeitempo wordt aandeel van 25% voorzien

#### Energiebesparing:

- 2020: **JA**: Nederland heeft tot en met 2018 al 593 petajoule bespaard
- 2030: **NEE**: Besparingstempo moet omhoog om het doel te bereiken



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- 06.2020 Minister of Economic affairs and Climate asks EPZ to investigate life time extension

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gescand met de gescand

2 JUN 2020

Datum 29 MEI 2020  
Betreft levensduurverlenging kerncentrale

Geachte heer Wolters,

De Provincie Zeeland heeft in haar Regionale Energie Strategie aangegeven dat kernenergie een rol speelt in de Zeeuwse CO<sub>2</sub>-vrije energiemix. De minister van Economische Zaken en Klimaat heeft vervolgens in antwoord op Kamervragen voor het Schriftelijk Overleg Klimaat en Energie op 23 april 2020 aangegeven, dat hij bij de vergunninghouder na zal gaan of hij het technisch en bedrijfseconomisch mogelijk acht, met inachtneming van daarvoor benodigde investeringen, dat de levensduur van de kerncentrale op een veilige manier wordt verlengd, en zo ja voor welke periode.

Het gaat in deze fase niet om een compleet overzicht van de benodigde investeringen, maar om een inschatting uwerzijds of gelet op de bij u bekende informatie;

- levensduurverlenging technisch haalbaar zou kunnen zijn
- de daarvoor benodigde investeringen - gelet op de huidige marktinzichten - bedrijfseconomisch verantwoord lijken
- de levensduur met 10 of 20 jaar verlengd zou kunnen worden waarbij de installatie blijft voldoen aan de geldende veiligheidseisen.

Voor de beantwoording van deze vragen, kunt u in deze fase uitgaan van de reeds bekende technische eisen, voorwaarden en standaarden voor een bestaande kerncentrale van het type dat in Borssele staat.

Mocht (een deel van) de informatie die u gaat verstrekken bedrijfsvertrouwelijk zijn, dan verzoek ik u dat aan te geven, zodat daar op gepaste wijze rekening mee kan worden gehouden.



Ministerie van Economische Zaken  
en Klimaat

Directoraat-generaal Klimaat  
en Energie

Directie Elektriciteit

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Ons kenmerk

DGKE-E / 20141901

Uw kenmerk

Bijlage(n)

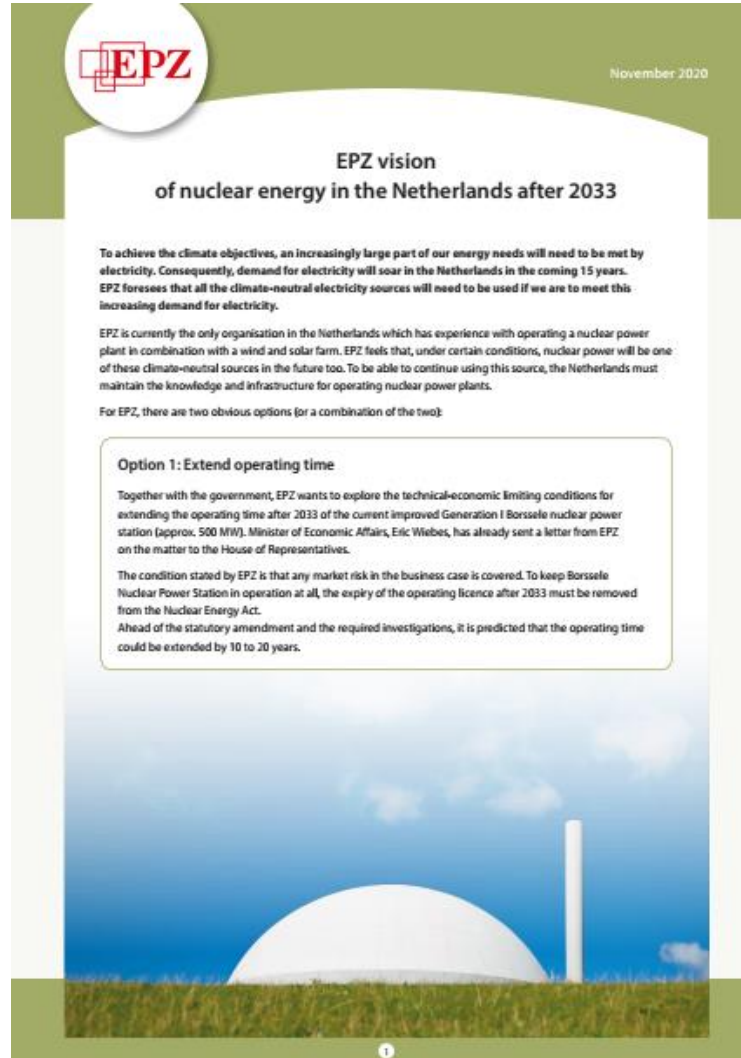
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- 11.2020 Strategy paper EPZ



EPZ vision  
of nuclear energy in the Netherlands after 2033

To achieve the climate objectives, an increasingly large part of our energy needs will need to be met by electricity. Consequently, demand for electricity will soar in the Netherlands in the coming 15 years. EPZ foresees that all the climate-neutral electricity sources will need to be used if we are to meet this increasing demand for electricity.

EPZ is currently the only organisation in the Netherlands which has experience with operating a nuclear power plant in combination with a wind and solar farm. EPZ feels that, under certain conditions, nuclear power will be one of these climate-neutral sources in the future too. To be able to continue using this source, the Netherlands must maintain the knowledge and infrastructure for operating nuclear power plants.

For EPZ, there are two obvious options (or a combination of the two):

**Option 1: Extend operating time**

Together with the government, EPZ wants to explore the technical-economic limiting conditions for extending the operating time after 2033 of the current improved Generation I Borssele nuclear power station (approx. 500 MW). Minister of Economic Affairs, Eric Wiebes, has already sent a letter from EPZ on the matter to the House of Representatives.

The condition stated by EPZ is that any market risk in the business case is covered. To keep Borssele Nuclear Power Station in operation at all, the expiry of the operating licence after 2033 must be removed from the Nuclear Energy Act.

Ahead of the statutory amendment and the required investigations, it is predicted that the operating time could be extended by 10 to 20 years.

1

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## Option 2: New build

EPZ supports the construction before the mid-thirties of two new Generation III 1,500 MW nuclear power plants in Borssele. The condition is the choice of a proven (and licensed) design for which the licensing and participation procedures can be completed in time. Subsequently, no changes to the design and regulations may be made during construction. Finally, it is essential that any market risk in the business case is covered by the government.

EPZ feels that the new construction of an existing, approved reactor concept is feasible. Nuclear power plants of the types *European Pressurized water Reactor* (EPR) and *Advanced Pressurized water Reactor* (APR) have already been licensed and are in operation. EPR and APR units are also under construction. These have been proved to be safe and reliable means of production.

These Generation III nuclear reactors generate three times the power of the Borssele I.

The existing Borssele I generates (rounded off) 500 MW, whilst a new Generation III reactor generates 1,500 MW. They are therefore extremely interesting in economic terms. Such nuclear reactors can already be purchased from various suppliers worldwide.

There is plenty of space for a new build in the immediate vicinity of the existing nuclear reactor. Building two identical nuclear reactors at once (with phased commissioning) seems the most optimal strategy.

- This would involve scale advantages in the construction and operation.
- The required technical personnel will be trained and qualified gradually by the existing EPZ organisation.

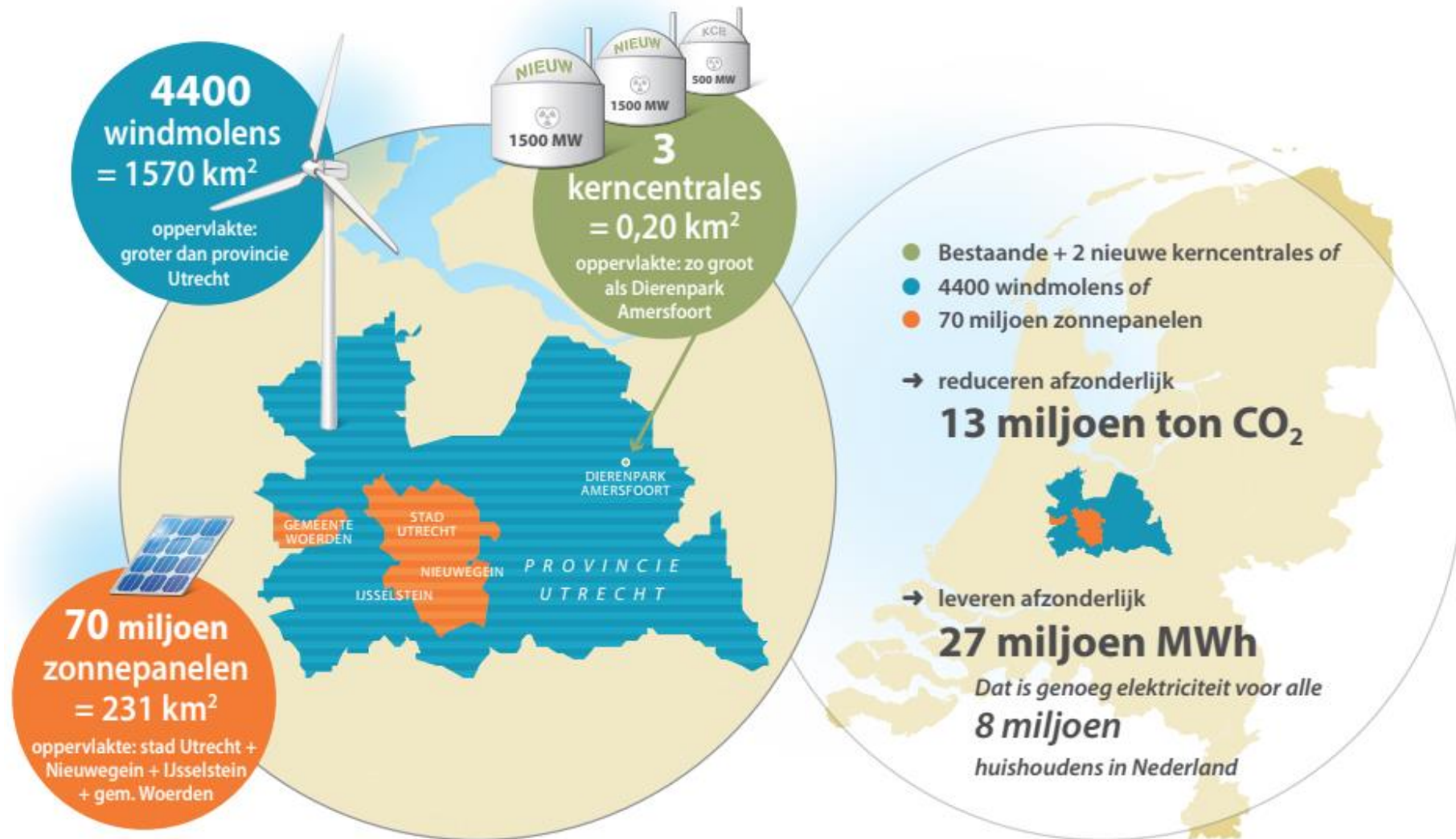
For a satisfactory project outcome, the costs of a new Generation III reactor are between 8 and 10 billion euros, and the construction takes around 8 years.

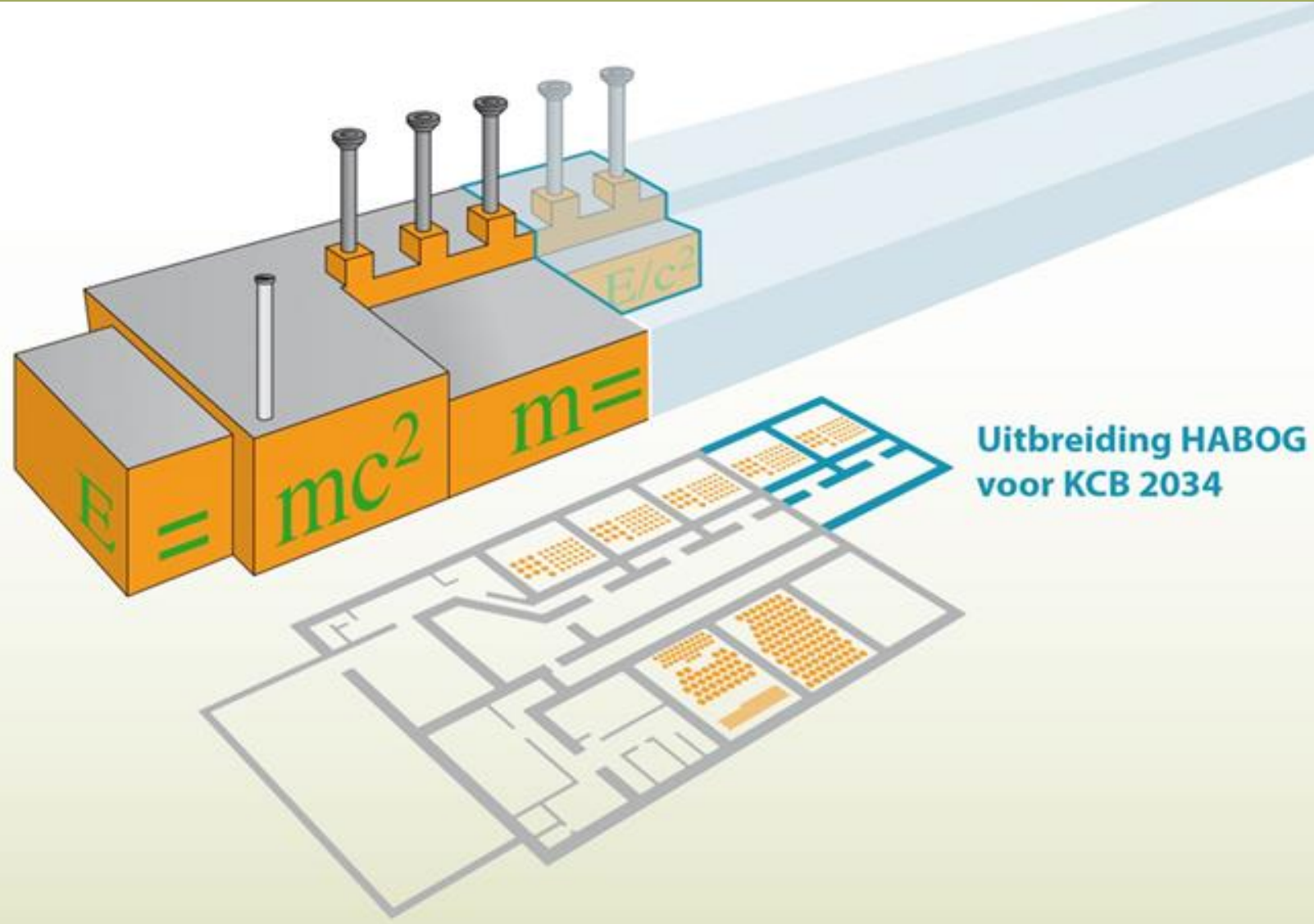


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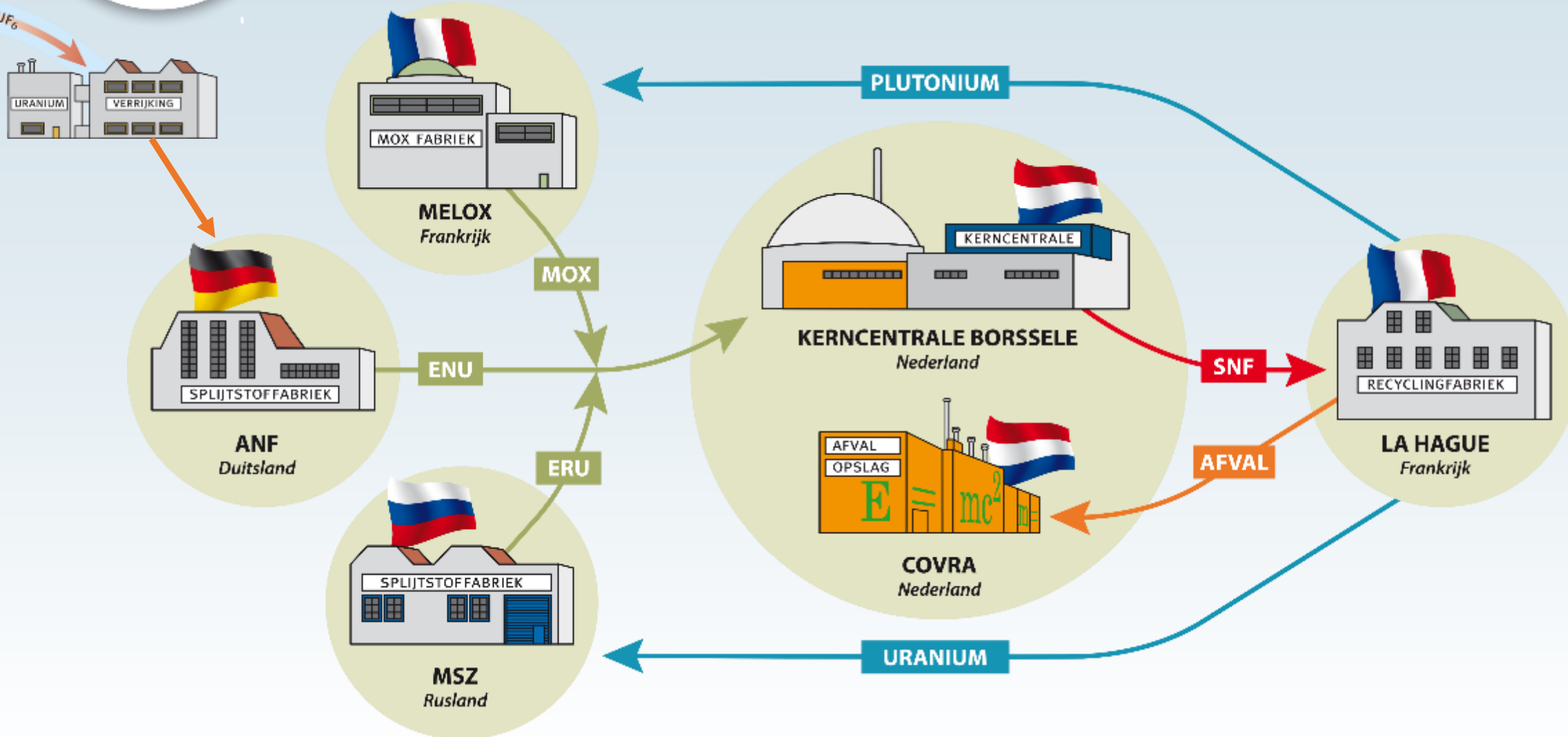
# Used space nuclear compared to solar and wind







# Continuation of the closed fuel cycle



# Cost per tonne CO2 avoided

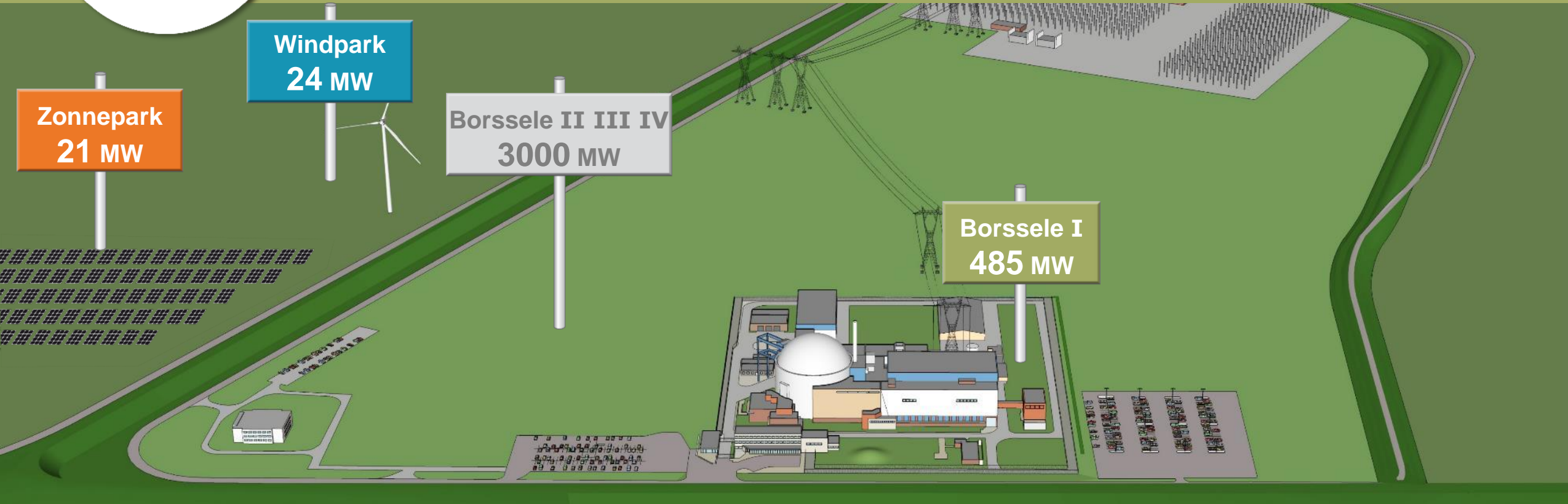
	Mton CO2	Costs per year € mrd	Cost effective- ness €/ ton CO2
Wind on shore	4	0.4	100
Solar-PV	3	0.4	125
CCS coal	22	0.6	27
CCS gas	6	0.5	83
Green gas	2	0.6	333
<i>Source: PBL nationale kosten energietransitie april 2017</i>			
Nuclear operating life time extension	2	0.05	25
Nuclear new build 2 units	13	1.0	77
<i>Source: Own data EPZ</i>			



# Financial operating experience

	Investment year	Investment in € mln	Capacity in MW	Investment per MW in € mln	Full load hours per year	Capacity factor	MWh per year	Operating years	Investment in € per MWh
Wind on shore EPZ II	2012	22	12	1,8	2.775	32%	34.133	20	32
Wind on shore EPZ III	2021	15	17	0,9	2.865	33%	48.700	20	15
Solar EPZ I	2019	13	18	0,7	1.135	13%	20.425	20	32
New nuclear EPZ II	2034	8.000	1.600	5,0	8.059	92%	12.894.720	60	10

comparing recent and future EPZ capex



## 2/3 new NPP in Borssele:

- Every year 30 million MWh CO<sub>2</sub> free electricity (30% of the Dutch large scale production)
- Every year for 10 million households CO<sub>2</sub> free electricity
- Reduce every year 15 million tonne CO<sub>2</sub>
- Every year substantial subsidy savings