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FACULTY OF ENGINEERING AND ARCHITECTURE

DEPARTMENT OF ELECTROMECHANICAL, SYSTEMS AND METAL ENGINEERING (EMSME)
ELECTRICAL ENERGY LAB

ADDRESSING THE CHALLENGES OF A NUCLEAR PHASE-OUT WITH ENERGY SYNERGIES ON BUSINESS PARKS

Joannes Laveyne – 1st World Energies Forum – 14/09 - 05/10 2020

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WEF 2020

energies

MDPI

IN THIS PRESENTATION

- The Belgian energy landscape: present and near future
- Role of business parks in the energy transition
  - Heat exchange
  - Cogeneration
  - Local Energy Communities
- Discussion & conclusions
- Aknowledgements
  - EU Intereg 2 Seas BISEPS project
  - EU Intereg 2 Seas LECSEA project
  - VLAIO Flux50 ICON ROLECS project

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THE BELGIAN ENERGY LANDSCAPE

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THE BELGIAN ENERGY LANDSCAPE

- In this presentation, we focus on *electrical* energy
- Final electricity consumption in Belgium is about 84 TWh
- Has been relatively stable for many years
  - Increased electrification is offset by efficiency gains in existing applications
- Electricity accounts for 21% of total primary energy consumption in Belgium

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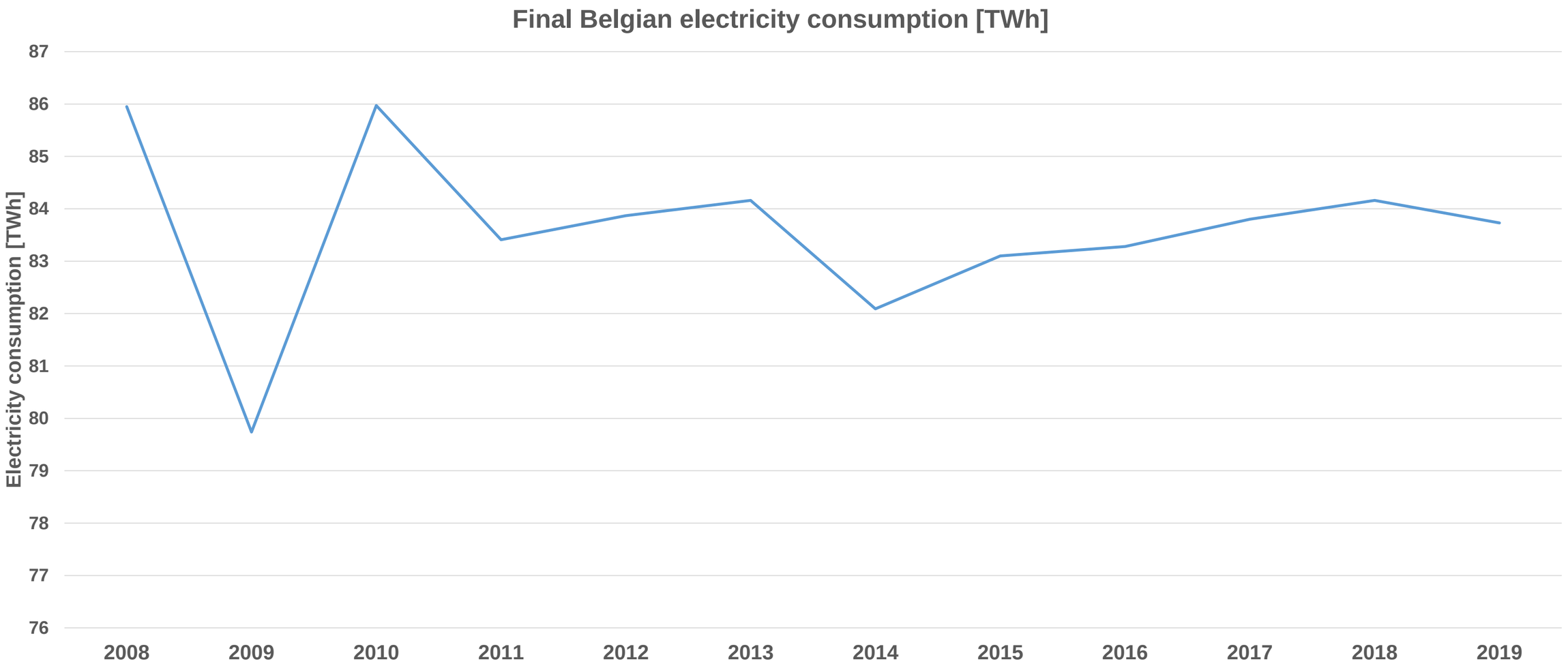
THE BELGIAN ENERGY LANDSCAPE



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THE BELGIAN ENERGY LANDSCAPE

- Electricity use is mainly for industrial purposes (47%)
- Commercial services (retail etc) make up 27%
- Residential use only makes up 21%
  - Buildings in Belgium are mainly heated by natural gas fired boilers

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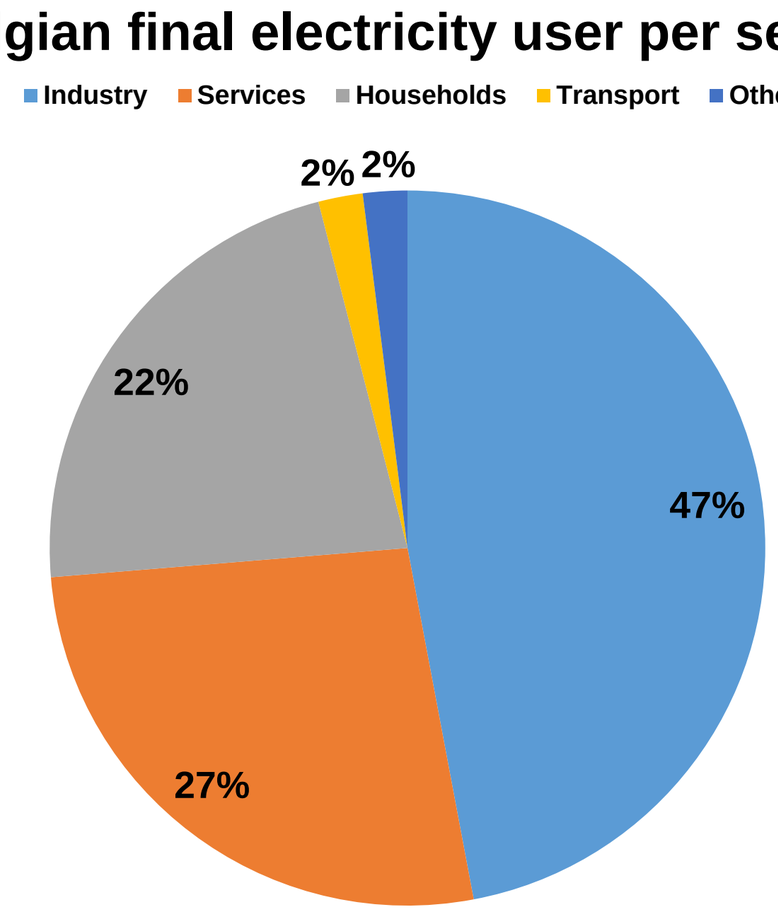
THE BELGIAN ENERGY LANDSCAPE



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THE BELGIAN ENERGY LANDSCAPE

- Electricity generation is more dynamic
- Belgium sometimes heavily relies on import, other years they are a net exporter
- Mainly due to inavailabilities of aging power plant fleet and introduction of renewables

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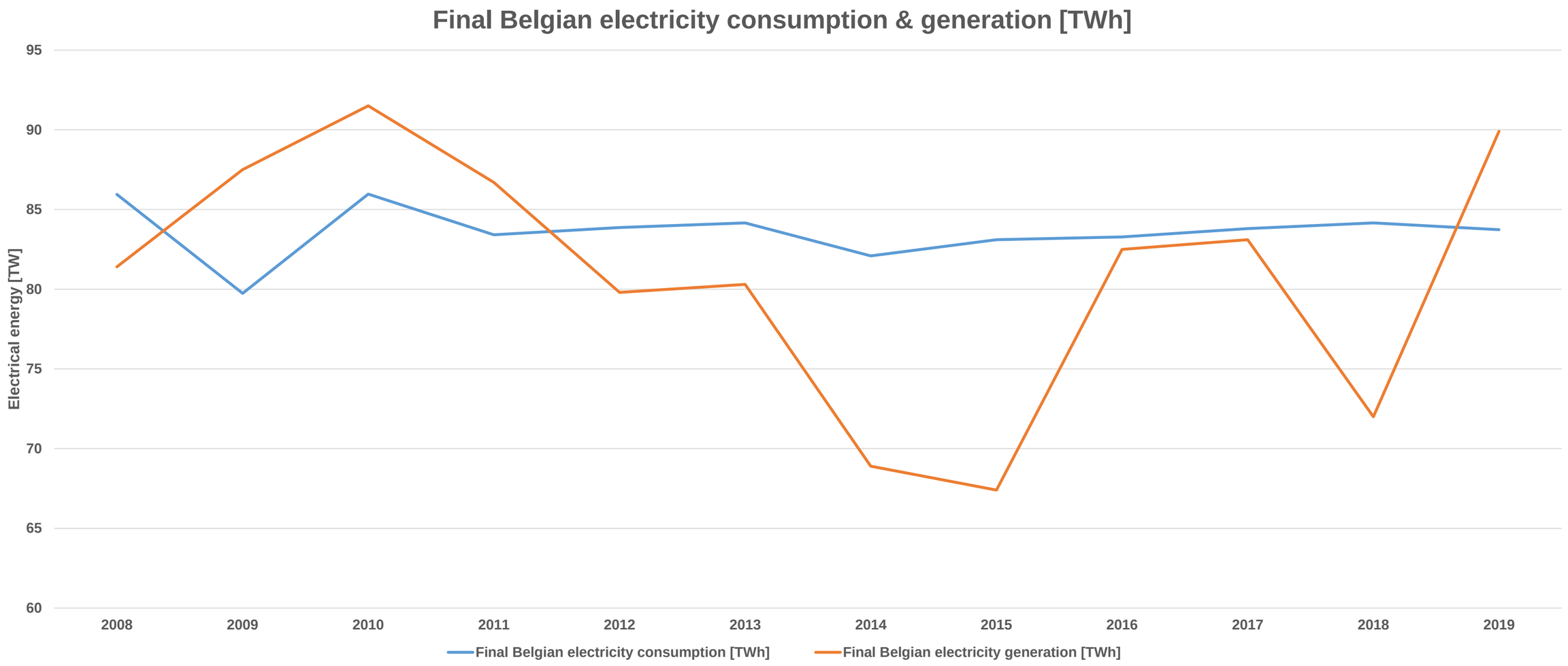
THE BELGIAN ENERGY LANDSCAPE



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THE BELGIAN ENERGY LANDSCAPE

- Electricity generation dominated by
  - Fossil fuel:
    - 32% of installed capacity
    - 34% of total energy generation
  - Nuclear power:
    - 25% of installed capacity
    - 47% of total energy generation

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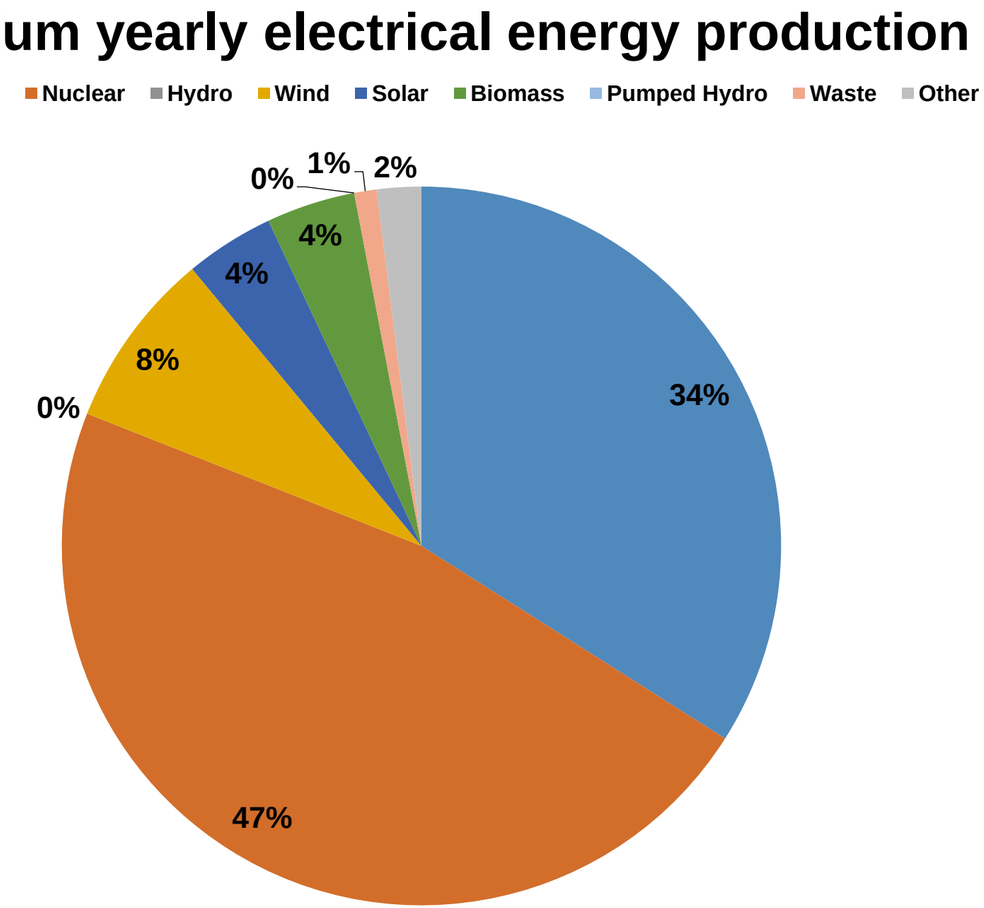
THE BELGIAN ENERGY LANDSCAPE



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THE BELGIAN ENERGY LANDSCAPE

- Starting in 2008, policies accelerating adoption of renewable energy sources (RES) have been put in effect
- Installed capacity of wind and photovoltaic (PV) power have shown rapid growth
- RES now makes up 36% of installed capacity
- Provide however only 14% of generated electricity

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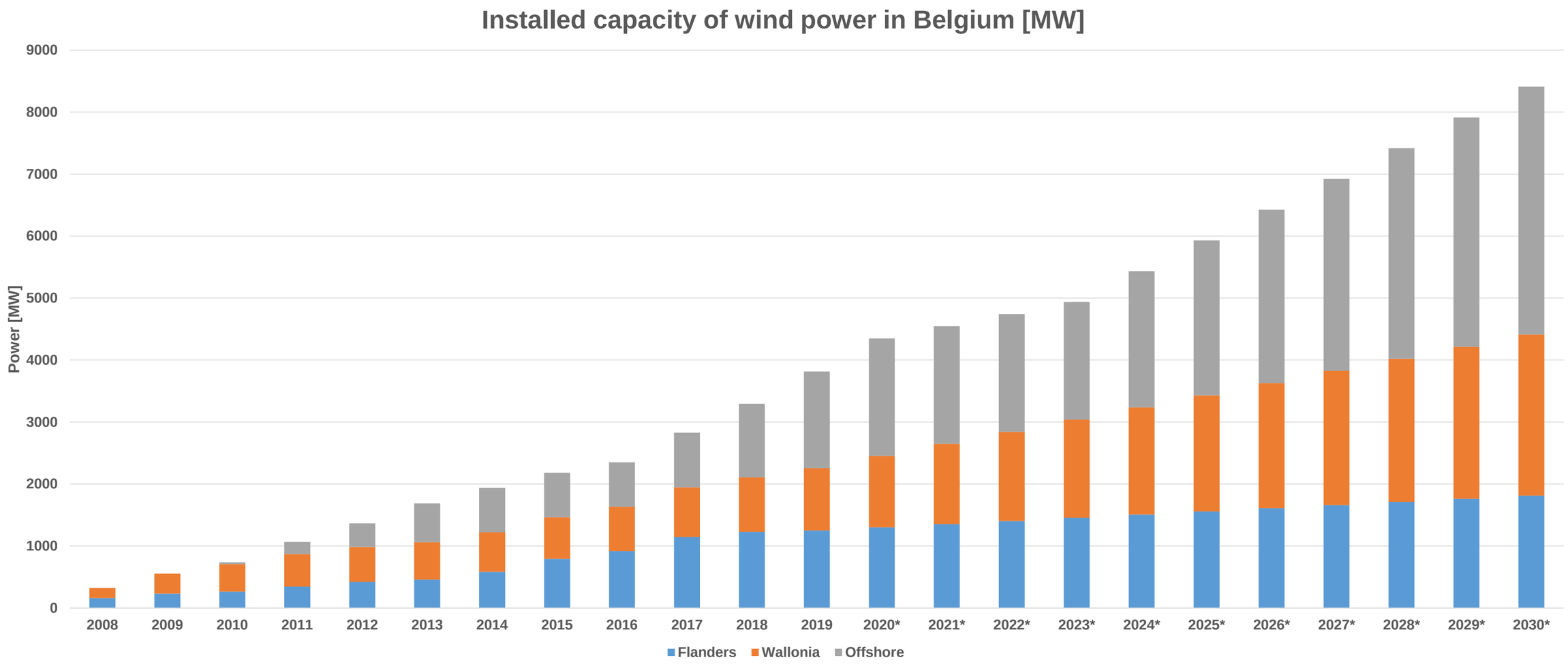
THE BELGIAN ENERGY LANDSCAPE



* Forecasts based on Belgian National Energy and Climate Plan (NECP)

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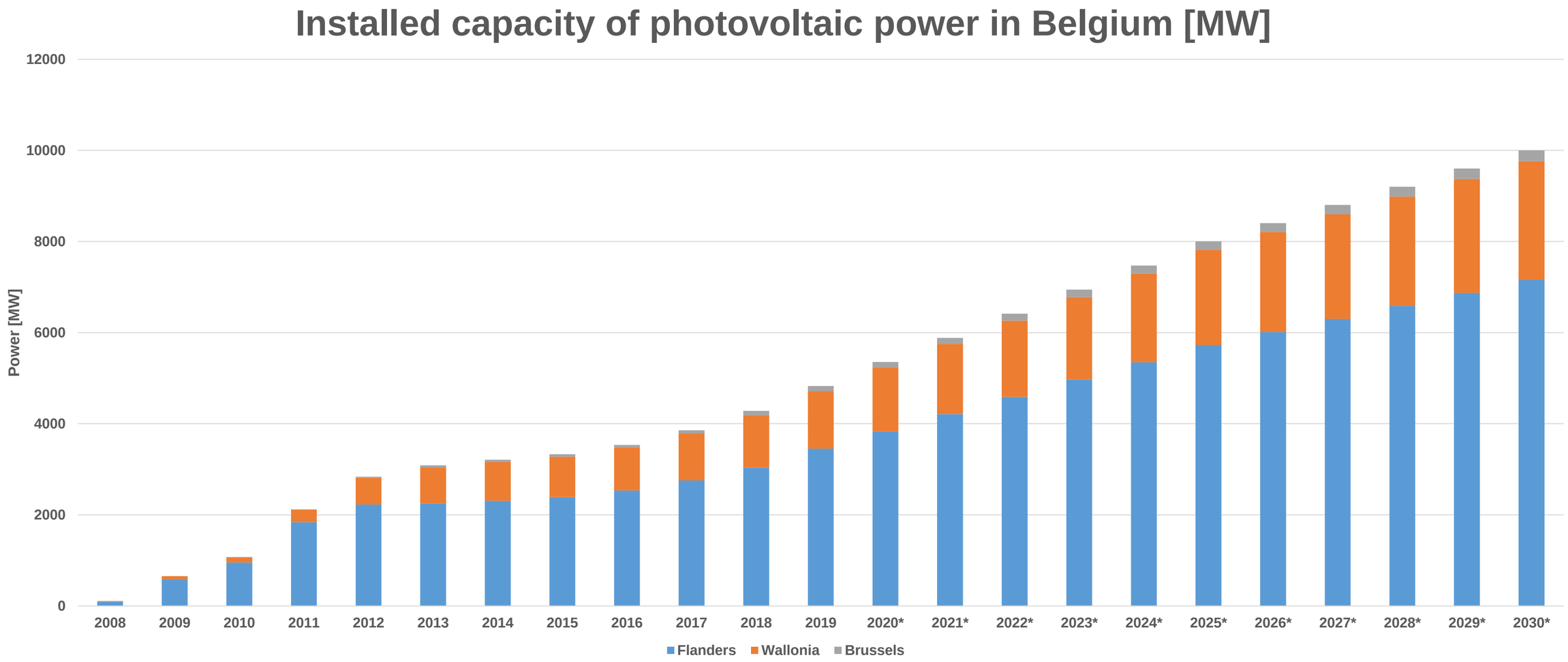
THE BELGIAN ENERGY LANDSCAPE



* Forecasts based on Belgian National Energy and Climate Plan (NECP)

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THE BELGIAN ENERGY LANDSCAPE

- By 2030, RES needs to provide 27,5% of domestic electricity consumption
- Requires more than doubling of current installed capacity (up to 19GW)
- Meanwhile, nuclear phaseout means 6GW of reactors will be shut down

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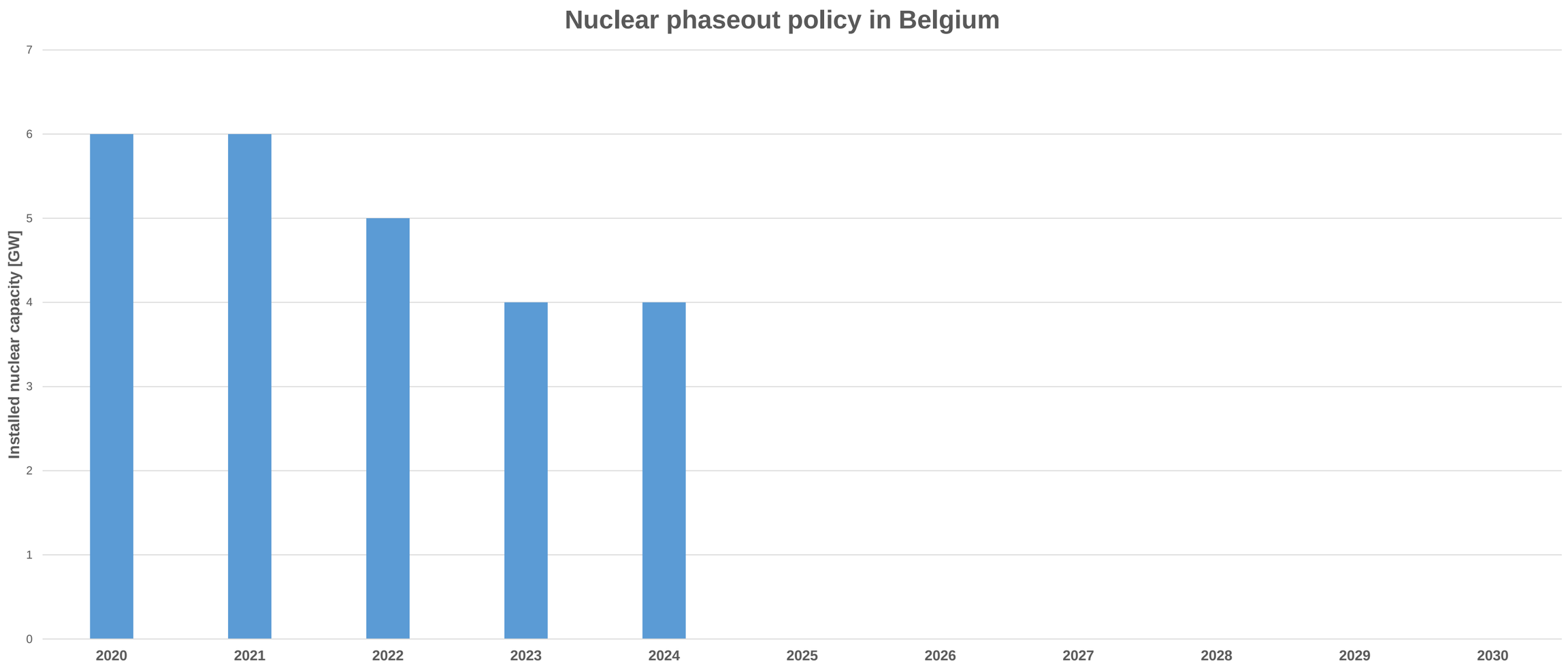
THE BELGIAN ENERGY LANDSCAPE



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THE BELGIAN ENERGY LANDSCAPE

- By 2030, Belgium will have a radically changed energy landscape, characterised by
  - High share of intermittent RES
  - Need for expanded flexibility, both in electricity consumption and generation
- This energy transition will require novel approaches to
  - Ensure investment commitment into RES
  - Lower Greenhouse Gas (GHG) emissions
  - Keep energy prices stable

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ROLE OF BUSINESS PARKS IN THE ENERGY TRANSITION

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ROLE OF BUSINESS PARKS

- Two main categories of industrial activity in Belgium:
  - Industrial clusters: large concentration of energy intense activities by large companies (petrochemical, steel industry, …)
  - Business parks: mix of high and low energy intensity and big and small companies, often also offering commercial services, distributed character

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ROLE OF BUSINESS PARKS

– Typical Belgian (Flemish) business park makeup

Nr	Business activity	Annual electricity demand	Potential PV
1	Plastic injection molding factory	5.000 MWh	314 MWh (only parts of roof) Third party investor
2	Construction of silos	100 MWh	60-105 MWh
3	Plastic recycling	900 MWh	135 MWh Old roof with asbestos
4	Renting party tents	20 MWh	15 MWh (10kWp inverter)
5	Garage workshop	47 MWh	15 MWh (10kWp inverter)
6	Metallurgy	8,5 MWh	12 MWh (8kWp inverter)
7	Automatisation	15,7 MWh	15 MWh (10kWp inverter)
8	Sheltered workshop	400 MWh	380 MWh

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ROLE OF BUSINESS PARKS

- Differences in energy consumption (type & amount) and potential for local energy generation
- By exploiting synergies and joint investments in local energy generation, business parks can become less reliant on upstream energy production while also mitigating GHG emissions

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HEAT EXCHANGE

- Most companies generate process heat individually
- Central generation can be more efficient
- Waste process heat can be used for space heating (e.g. offices)
- Requires heat exchange network

HEAT EXCHANGE

	1st generation	2nd generation	3th generation	4th generation	5th generation
Description	High power steam pipes	Pressurised hot water pipes	Pressurised hot water pipes	Hot water pipes	Ambient temperature piping
Temperature	Up to 200°C	>100°C	<100°C	<65°	5-25°C
Utilisation	Low	Medium	Medium	Medium	High
Heat source	(Fossil) thermal plant	(Fossil) thermal plant	Thermal plants, electricity plants, process waste heat	Thermal plants, electricity plants, process waste heat, high temperature solar or heat pump	Waste heat, solar heat, building heat (cooling)
Distribution (producer to consumer)	One to one	One to one	One to many	One to many	Many to many, both heating and cooling

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HEAT EXCHANGE

Planned test on pilot site

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COGENERATION

- In stead of producing thermal power, produce electricity and use waste heat as feed-in for heat exchange grid
- Increase exergy for given unit of GHG emission
- Combined Heat and Power (CHP) plant

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LOCAL ENERGY COMMUNITIES

- To increase investment business case in CHP + heat exchange grid, electricity must be shared between companies as well
  - Monetary value of electricity surpasses that of heat
- While heat exchange grids are not regulated under EU directives, electricity exchange is

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LOCAL ENERGY COMMUNITIES

- Recast of the Renewable Energy Directive (RED II) allows for ‘energy communities’

(71) The specific characteristics of local renewable energy communities in terms of size, ownership structure and the number of projects can hamper their competition on an equal footing with large-scale players, namely competitors with larger projects or portfolios. Therefore, it should be possible for Member States to choose any form of entity for renewable energy communities, provided that such an entity may, acting in its own name, exercise rights and be subject to obligations. To avoid abuse and to ensure broad participation, renewable energy communities should be capable of remaining autonomous from individual members and other traditional market actors that participate in the community as members or shareholders, or who cooperate through other means such as investment. Participation in renewable energy projects should be open to all potential local members based on objective, transparent and non-discriminatory criteria. Measures to offset the disadvantages relating to the specific characteristics of local renewable energy communities in terms of size, ownership structure and the number of projects include enabling renewable energy communities to operate in the energy system and easing their market integration. Renewable energy communities should be able to share between themselves energy that is produced by their community-owned installations. However, community members should not be exempt from relevant costs, charges, levies and taxes that would be borne by final consumers who are not community members, producers in a similar situation, or where public grid infrastructure is used for those transfers.

(72) Household consumers and communities engaging in renewables self-consumption should maintain their rights as consumers, including the rights to have a contract with a supplier of their choice and to switch supplier.

(73) Representing around half of the final energy consumption of the Union, the heating and cooling sector is considered to be a key sector in accelerating the decarbonisation of the energy system. Moreover, it is also a strategic sector in terms of energy security, as around 40 % of the renewable energy consumption by 2030 is projected to come from renewable heating and cooling. However, the absence of a harmonised strategy at Union level, the lack of internalisation of external costs and the

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LOCAL ENERGY COMMUNITIES

- Recast of the Renewable Energy Directive (RED II) defines ‘energy communities’
- Two main types
  - Renewable Energy Community (REC)
  - Citizen Energy Community (CEC)

(71) The specific characteristics of local renewable energy communities in terms of size, ownership structure and the number of projects can hamper their competition on an equal footing with large-scale players, namely competitors with larger projects or portfolios. Therefore, it should be possible for Member States to choose any form of entity for renewable energy communities, provided that such an entity may, acting in its own name, exercise rights and be subject to obligations. To avoid abuse and to ensure broad participation, renewable energy communities should be capable of remaining autonomous from individual members and other traditional market actors that participate in the community as members or shareholders, or who cooperate through other means such as investment. Participation in renewable energy projects should be open to all potential local members based on objective, transparent and non-discriminatory criteria. Measures to offset the disadvantages relating to the specific characteristics of local renewable energy communities in terms of size, ownership structure and the number of projects include enabling renewable energy communities to operate in the energy system and easing their market integration. Renewable energy communities should be able to share between themselves energy that is produced by their community-owned installations. However, community members should not be exempt from relevant costs, charges, levies and taxes that would be borne by final consumers who are not community members, producers in a similar situation, or where public grid infrastructure is used for those transfers.

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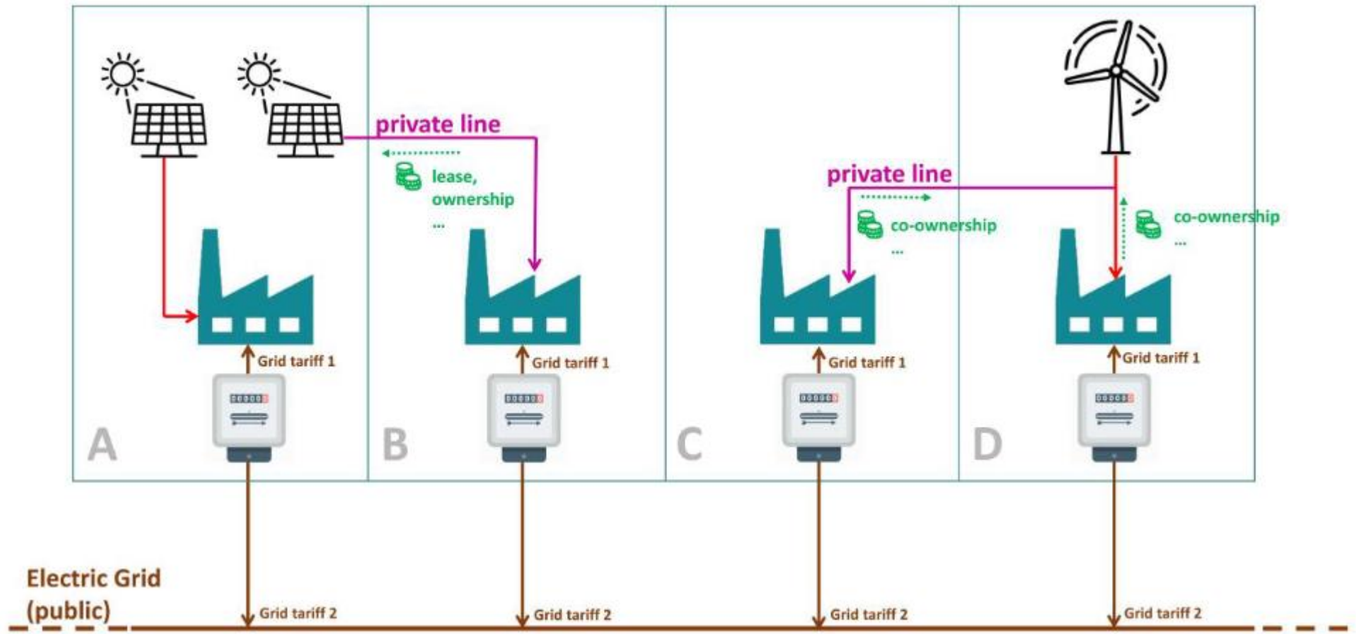
LOCAL ENERGY COMMUNITIES

– Requirements

	Citizen Energy Community	Renewable Energy Community
Energy production	From renewable sources or qualitative CHP	From renewable sources
Selfconsumption, trading, storage	Allowed within community	Allowed within community
Sale of energy	Allowed within or outside the community	Allowed within the community
Grid services	Flexibility, aggregation, EV charging	Flexibility, aggregation
Shareholders	Natural persons, small enterprises, local government	Natural persons, SMEs, local government
Locality criterium	No	Yes

LOCAL ENERGY COMMUNITIES

- Private line



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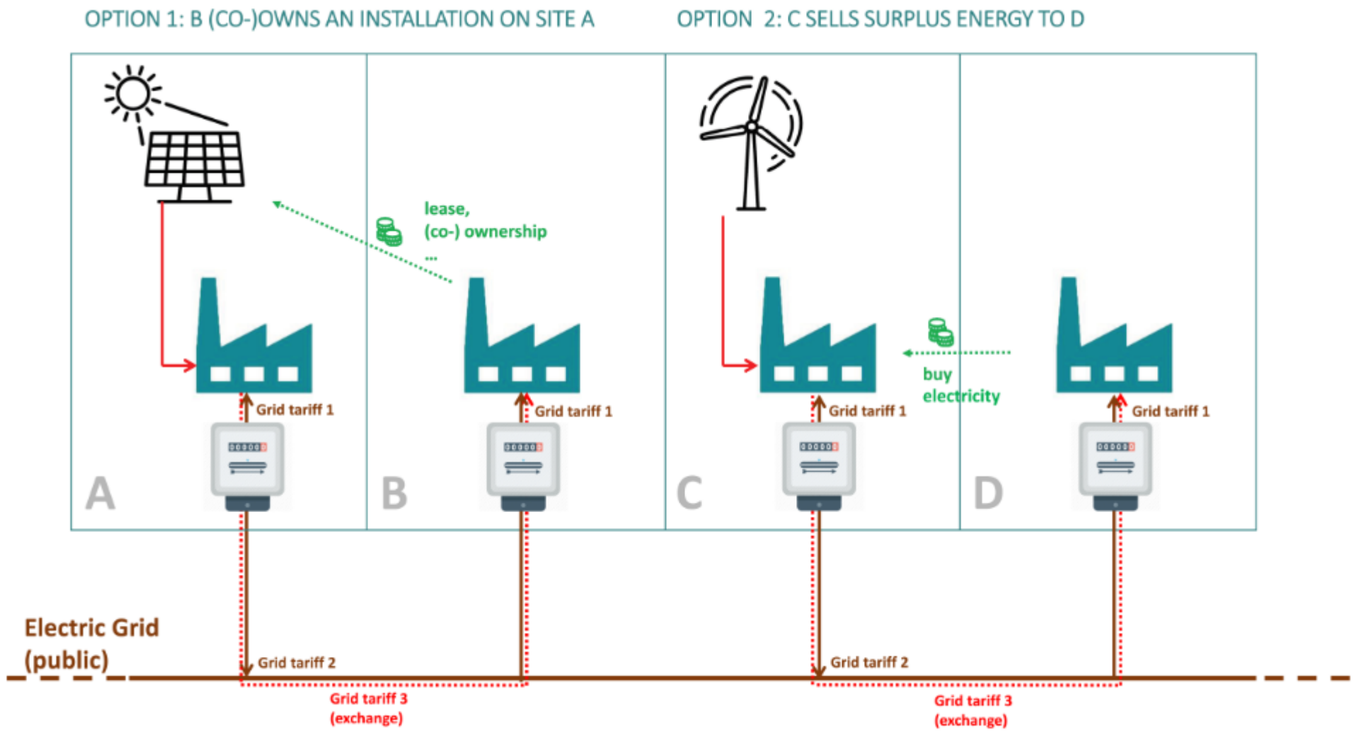
LOCAL ENERGY COMMUNITIES

- Energy exchange over public grid infrastructure



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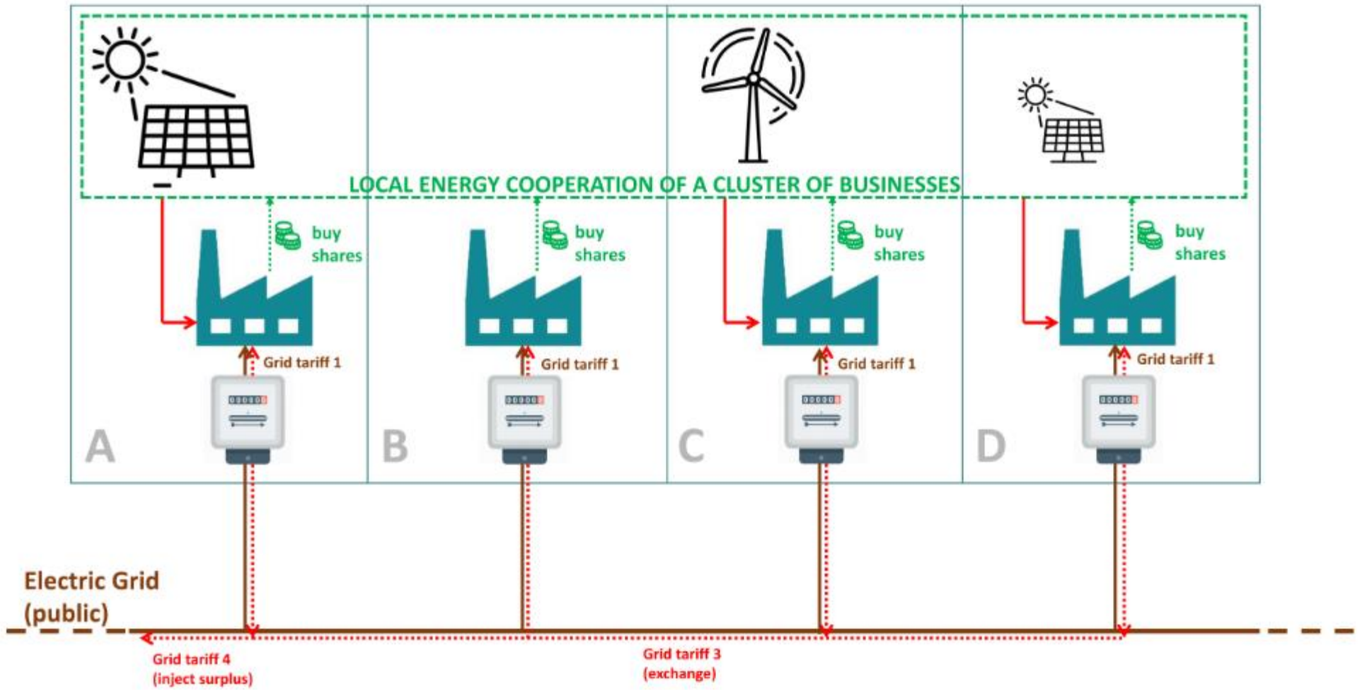
LOCAL ENERGY COMMUNITIES

- Local energy cooperation



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DISCUSSION & CONCLUSIONS

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DISCUSSIONS AND CONCLUSIONS

- Combination of cogeneration, heat exchange and energy community shows great potential to exploit synergies between companies, increase local energy production and reduce GHG emissions
- Tests underway on three pilot sites

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DISCUSSIONS AND CONCLUSIONS

- Regulatory framework for energy communities excludes large companies, requires private citizen involvement
- Recommendation: policy change to allow ‘professional’ energy communties tailored for implementation on business parks

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DISCUSSIONS AND CONCLUSIONS

- Energy communities only allow energy from renewable sources
- Qualitative cogeneration (less GHG emissions than if both heat and electricity were generated individually) is not defined as renewable
- Recommendation: also allow qualitative cogeneration as energy source in energy community

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DISCUSSIONS AND CONCLUSIONS

- Energy communities only allow exemptions on energy regulation, not distribution grid tariffs
- In countries with high tariffs, this makes business case void
- Recommendation: lower grid tariffs with tax shift to other components (e.g. carbon tax)

ACKNOWLEDGEMENTS

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EU INTEREG 2 SEAS BISEPS PROJECT

- **Business clusters Integrated Sustainable Energy PackageS**, aiming to reduce CO2 emissions at business cluster level by creating energy synergies among businesses
- Test on 5 pilot sites clusters
- http://www.biseps.eu/

empower carbon reduction in business

BISEPS

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Funding parties

met de steun van west-vlaanderen de gedreven provincie

Interreg 2 Seas Mers Zeeën European Regional Development Fund

Project partners

LEIE DAL

POM maakt werk van West-Vlaanderen

WVI linkt gemeentes

MEL MÉTROPOLE EUROPÉENNE DE LILLE

Gemeente Breda

west sussex county council

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CD2e ACCÉLÉRATEUR DE L'ÉCO-TRANSITION

EU INTEREG 2 SEAS LECSEA PROJECT

- **Local Energy Communities for the 2 Seas region**, accelerating a successful take-off of Energy Communities (EC's) in the 2-Seas

Funding parties

Project partners

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VLAIO ROLECS PROJECT

- **Rollout of Local Energy Communities**
- Gain a deeper understanding of the development and role of **Local Energy Communities (LECS) in Belgium & in Europe**
- https://rolecs.eu/

ROLECS

Funding parties

Vlaanderen is ondernemen

AGENTSCHAP INNOVEREN & ONDERNEMEN

innoviris .brussels we fund your future

Project partners

ABB, ENGIE Electrabel, FARYS, KU LEUVEN, BLIXT, AGENTSCHAP INNOVEREN & ONDERNEMEN, innoviris .brussels we fund your future, VITO, Open Motics, METHA advocaten | bemiddeling, anteagroup, UNIVERSITEIT GENT, Energent, magenta tree, DuCoop, 70GigaWatt, Aspium EXPERTS IN SUSTAINABLE BUILDINGS, fieldfisher, Aspiravi ENERGY, POWERDALE, 3E, imec, fluvius, C-VALLEY LEUVEN, Energy Ville, ENGIE Laborelec, IDLab INTERNET & DATA LAB, flux50, KBC, THINK-E, QUARES, imec-mict-ugent, wattson, VUB VRIJE UNIVERSITEIT BRUSSEL, ThermoVault

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