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Business case for CHP (DHC) in Poland Experience gained during development of the study „Comprehensive assessment…”

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Agenda

- Description of current state and conditions for DHS development (in particular CHP) based on „Comprehensive assessment of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling in Poland”
- What are the challenges of the DHC/CHP systems in Poland?

„Comprehensive assessment of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling in Poland”

THE APPLICATION POTENTIAL OF HIGH-EFFICIENCY COGENERATION

Base for the study

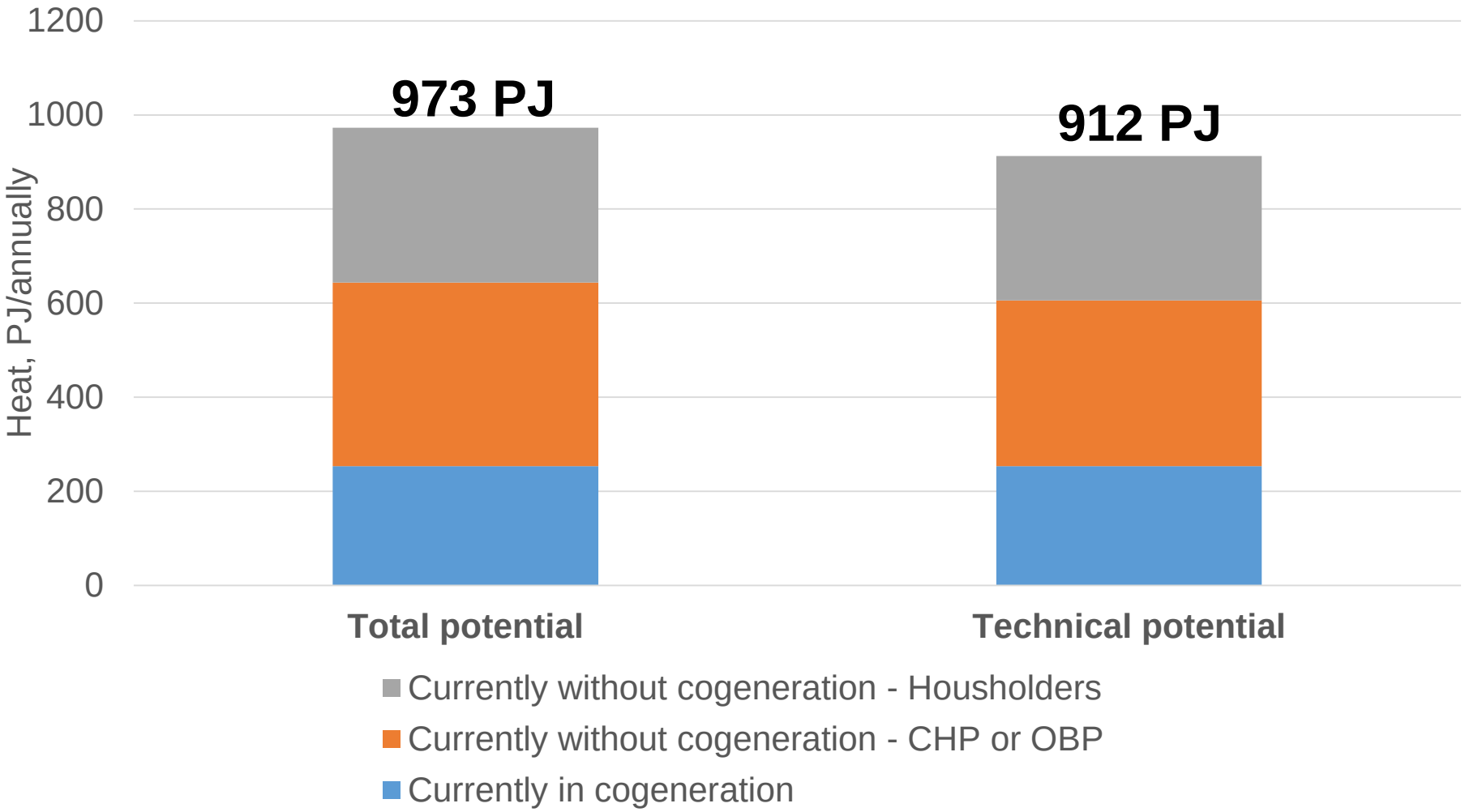
- The independent study „Comprehensive assessment of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling in Poland” was done on the request from:
  - Polskie Towarzystwo Elektrociepłowni Zawodowych
  - Izba Gospodarcza Ciepłownictwo Polskie
  - Izba Energetyki Przemysłowej i Odbiorców Energii
  - Izba Gospodarcza Gazownictwa

The study was done by ***Instytut Badań Stosowanych Politechniki Warszawskiej (The Institute of Applied Research - Warsaw University of Technology)***

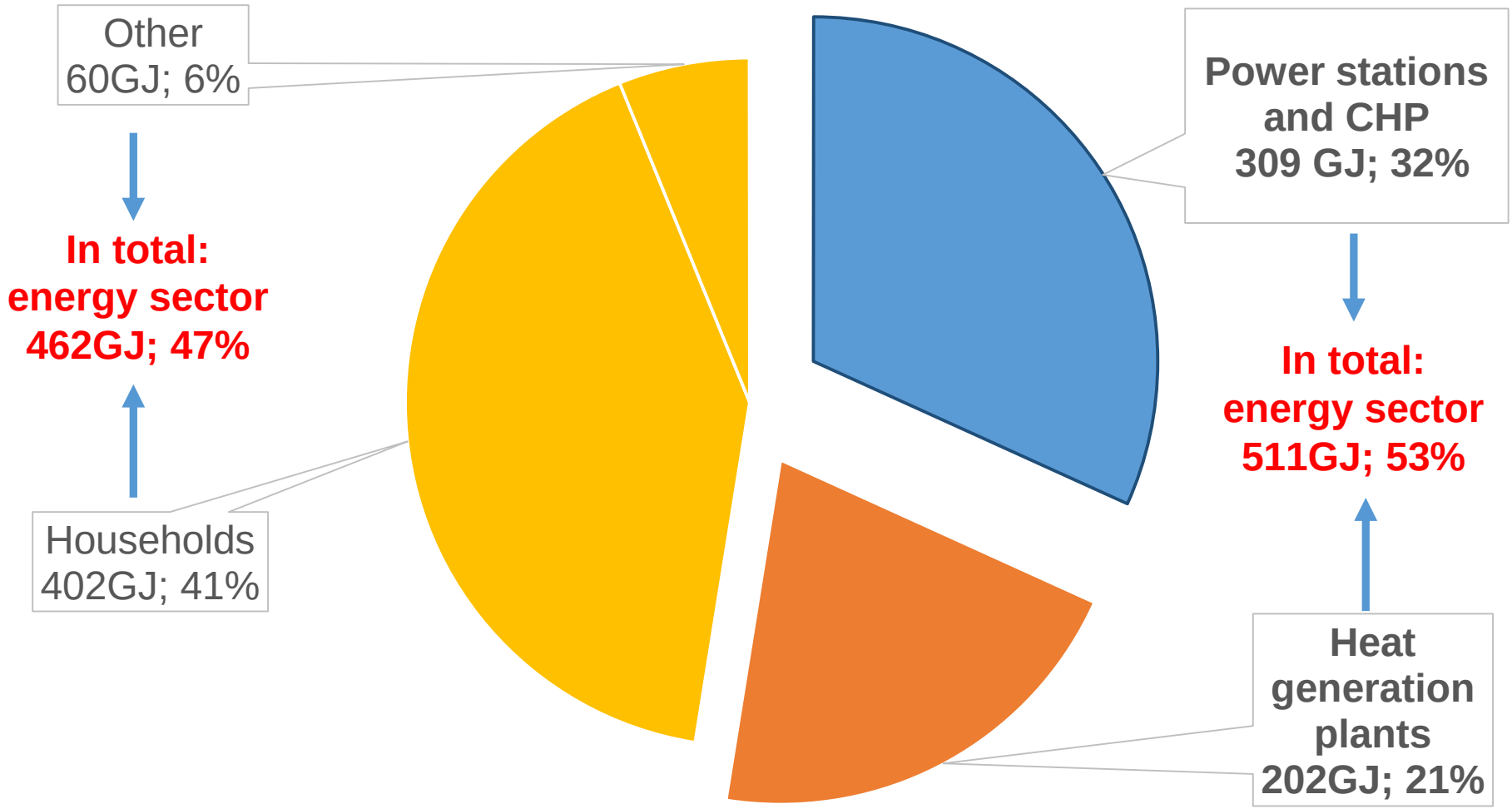
Data collecting for assessment

- There is no good source for heat map in Poland – typical situation
- Polish current reporting system (until now) is concentrated on electricity consumption statistics
- According to recommendations, following three potentials are estimated:
  - Heat demand for heating and cooling (the only heat for heating purpose was possible to be identified) – the total potential
  - Technical potential – according to the guidelines, discretional estimation
  - Economic potential – the value NPV > 0 for economic analysis

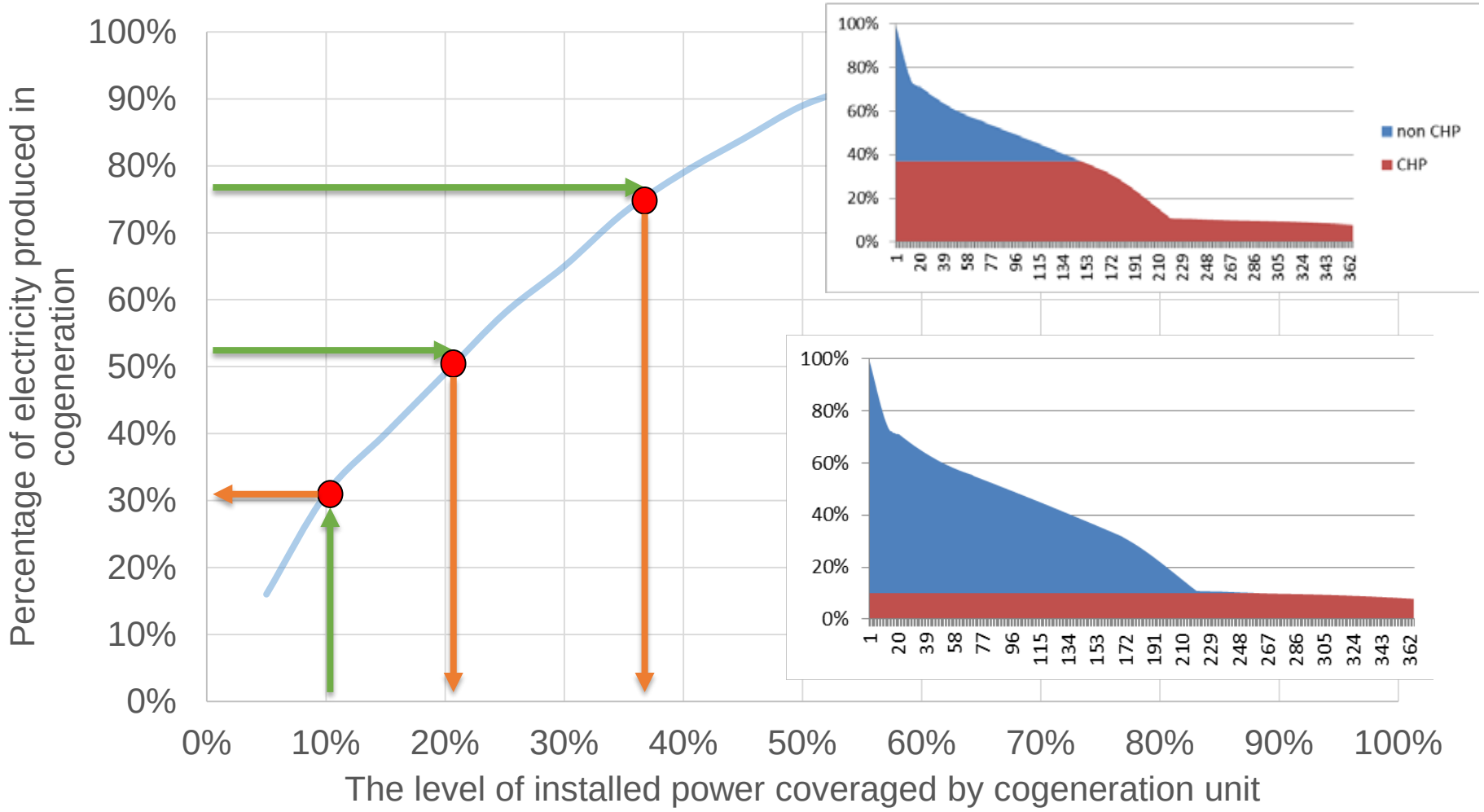
Total and technical potential



Heat generation in Poland, [PJ; %]



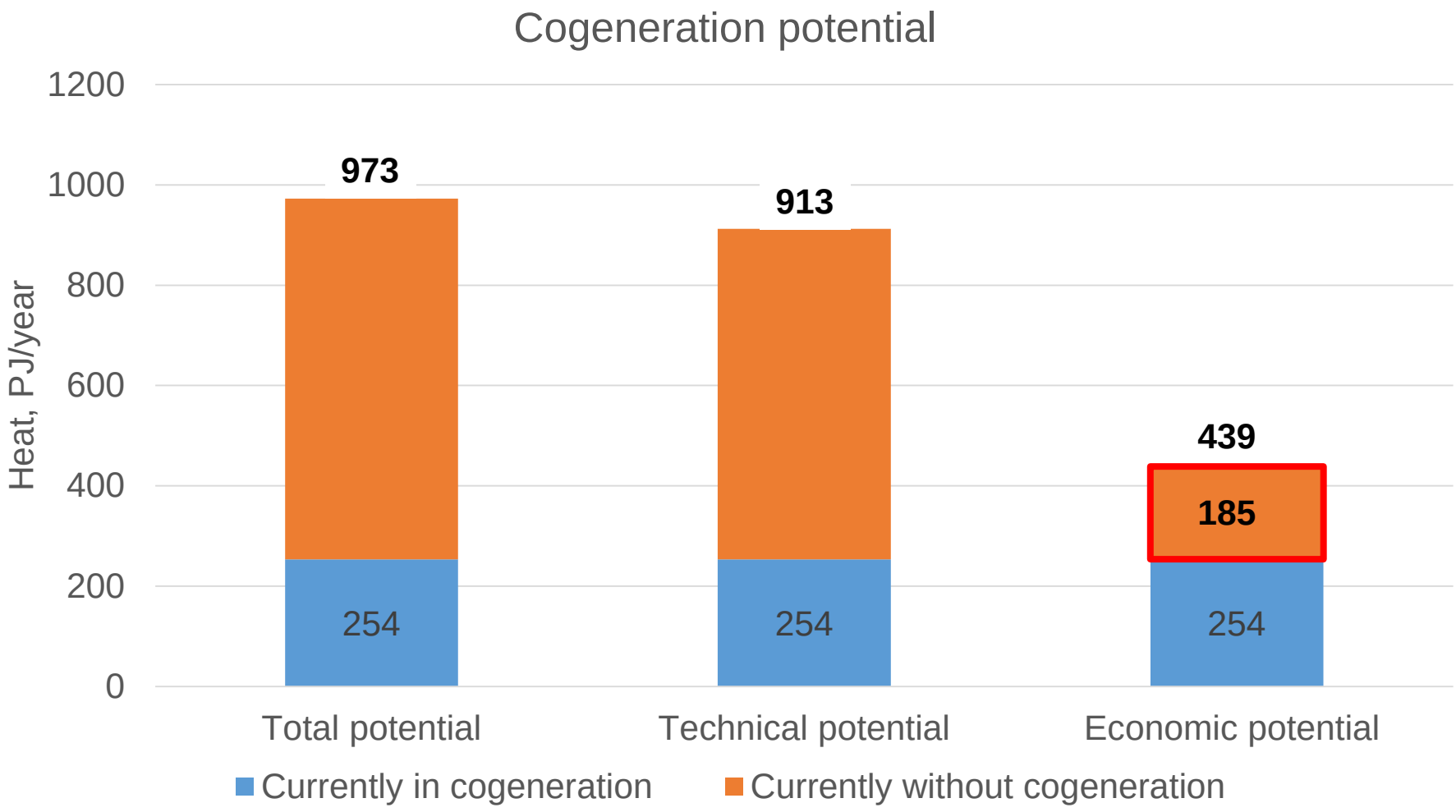
The relative (%) heat production as a function of relative (%) installed power



The potential division for categories Considered technologies

Power range	Economically justified technologies (economic NPV>0)
$Q \geq 20\ MW$	CCGT, hard coal fired power plant
$1 \leq Q < 20\ MW$	Gas turbine, reciprocating engines
Small scale ($Q < 1\ MW$)	Reciprocating engines
Households	No technology

Estimation of the cogeneration potential



Examination of various variants

Power range	NPV value maximization	The use of coal technologies (if justified)
	Technologies economically justified (economic NPV >0)	
$Q \geq 20\ MW$	CCGT	hard coal fired power plant
$1 \leq Q < 20\ MW$	Gas turbine, gas engines	
Small scale ($Q < 1\ MW$)	Gas engines	
Hous holders	No technology	

Current energy prices

On the basis of data provided by President of Energy Regulatory Office:

- Average price of electricity generated in high-efficiency cogeneration units in 2015:
  - ~40 €/MWh
- Average unit heat price produced in generation units, which are not cogeneration units in 2015:
  - coal-fired units ~9,5 €/GJ
  - gas-fired units 17,5 €/GJ
  - oil-fired units 25,5 €/GJ
  - units based on renewable energy sources 10,8 €/GJ

During the study, it was assumed that the utilization of potential will not change the current unit heat prices (price will be different for systems currently based on gas and coal)

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Financial analysis

- **The supporting mechanism for each technology was not examined**
- **Authors did not make a detailed analysis of the needed support**
- **…..but only the required level of support was estimated**

The development of cogeneration

Coal technology cogeneration development	Gas technology cogeneration development
Higher unit investment	Lower unit investment
Socially beneficial (less than gas technology)	The most socially beneficial
Lower reduction of CO_2 emission	The highest reduction of CO_2 emission
Little or no need for operational support for technology	The necessity of a major support for technology operation
The need (lower then for gas) to support the investment?	The need to support the investment

No possibility to clearly indicate the technology!
No technology will develop without the supporting mechanism

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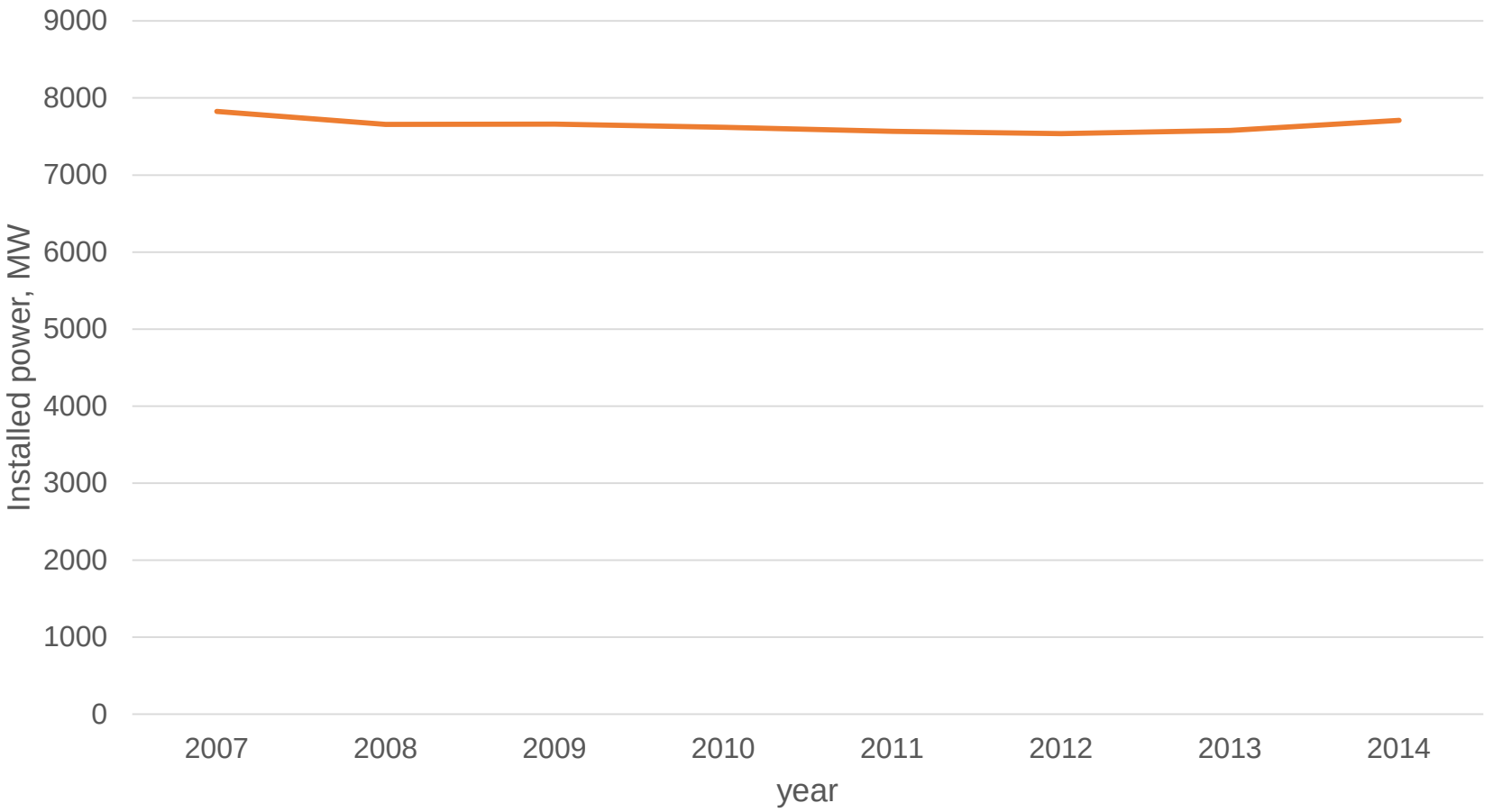
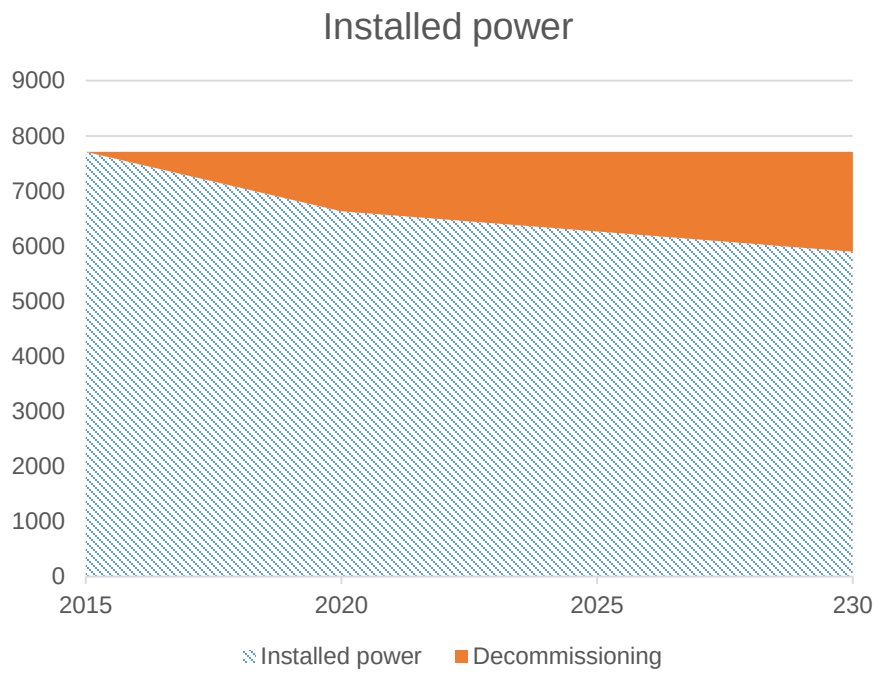
CHALLENGES

The problem: installed power in CHP



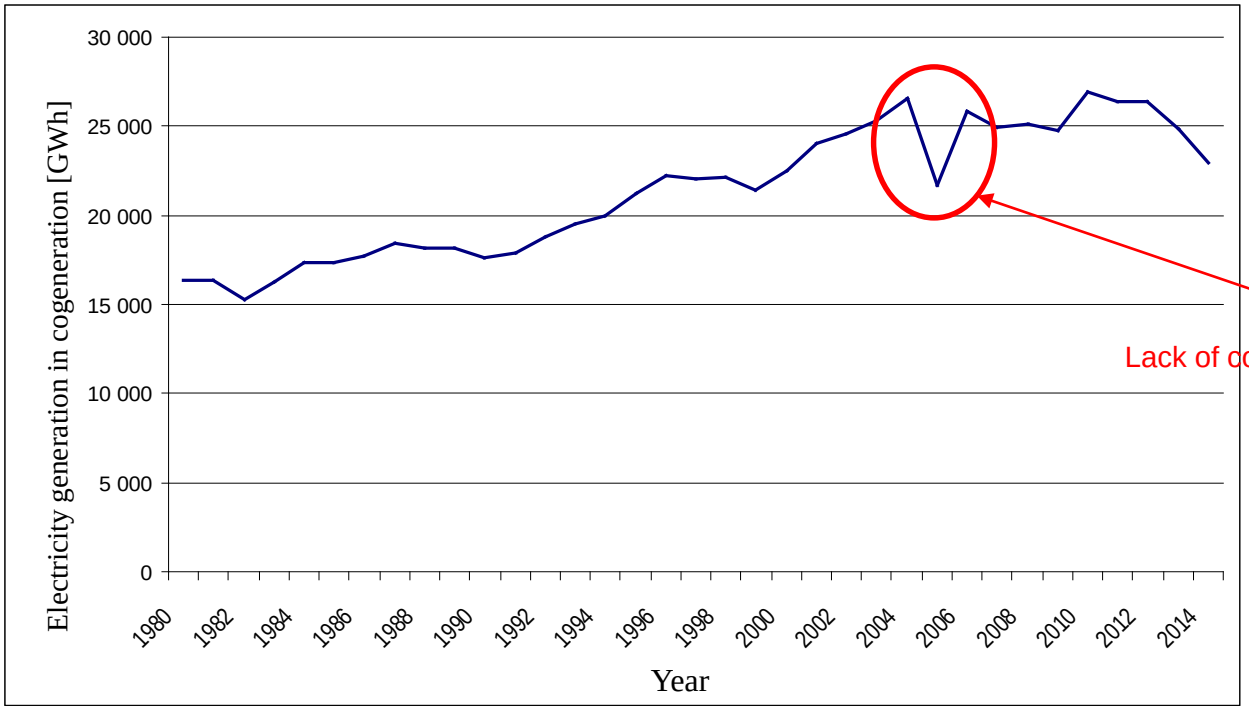
Decommissioning of operating generation units in CHP



- In the next 15 years, the ca. 1800 MW will be decommissioned
- The significant part of power is planned to be recreated, while:
  - The most of the planned investments are waiting for the confirmation of support mechanism

Together with the general lack of power in the power system, the decrease of CHP power could be a significant problem

Problem of cogeneration support system



Every lack of support mechanism results in significant decrease of electricity produced in cogeneration

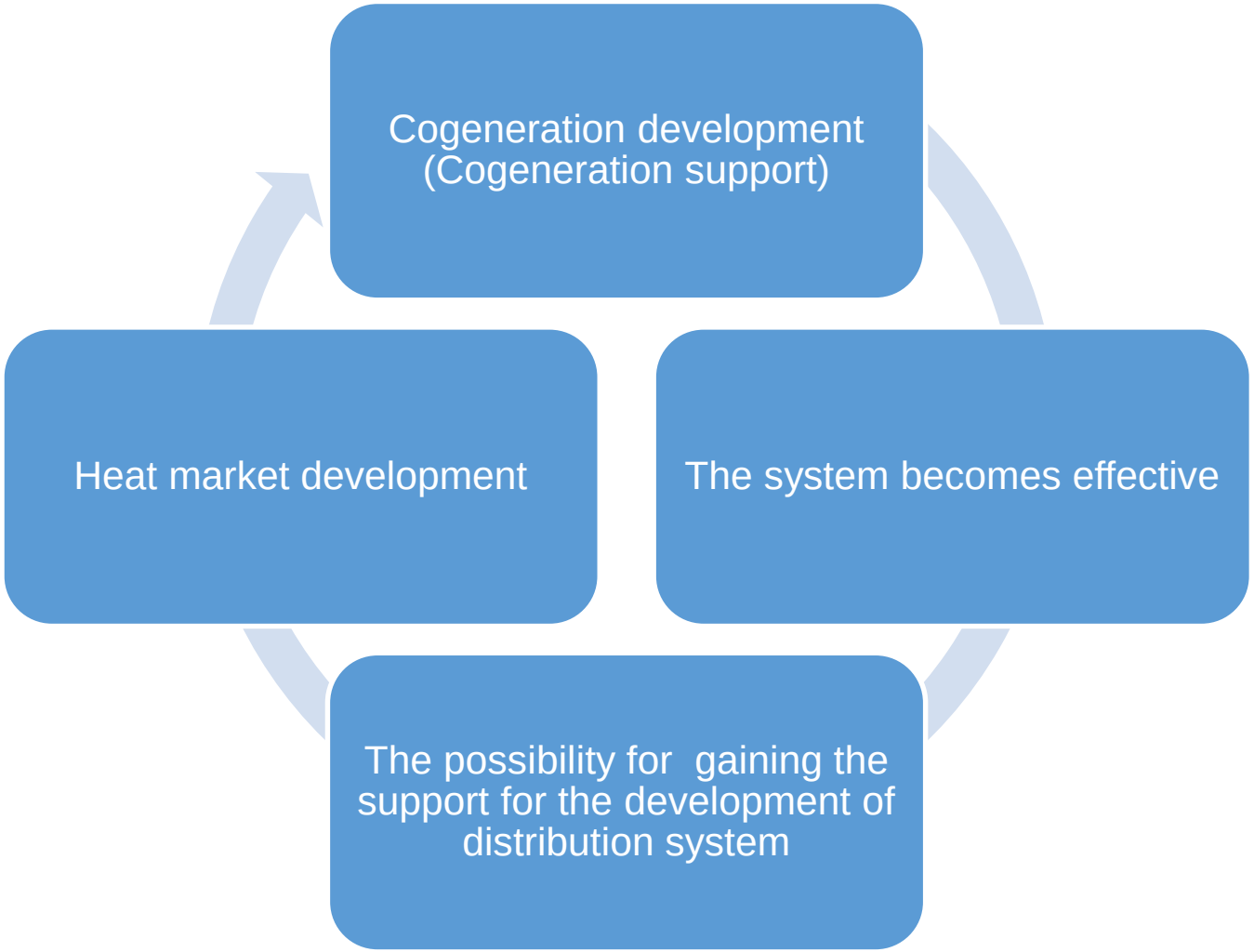
Development of small-scale DHSs

- Current situation of district heating systems:
  - Cities are the owners of the most of small-scale DHSs
  - Cities have very limited investment capacities
  - The most of DHSs are old systems, in which invested capital was returned a long time ago, and the current unit heat price allows to cover the only variable cost

- Future of district heating systems:
  - Entry into force the MCP Directive and the need for signficant investment in the modernization of generation units
  - Currently (without a support or with small support) the development of cogeneration does not give a competitive advantage – the lack of profitability
  - CAPEX for CHP is greater then for only boiler
    - Gas fired CHP 950 €/kW
    - Gas fired boiler 90 €/kW

What decision will the investor make (especially the city as an investor)?

DHS development



The problem: cooperation between heat producer and heat distributor

- Heat producer is the one responsible for the system effectiveness
- The only distributor can apply for financing and he takes responsibilities for „losses”

- A distributor is responsible for end users connection (he has to invest)
- The heat generation units gets 2/3 of the income (if it’s no need to build new capacity)

- The achievement of the greatest benefits in DHSc is possible due to cooperation between distributor and heat producer

Currently in Poland, the problem in communication between heat distributor and heat producer could be observed.

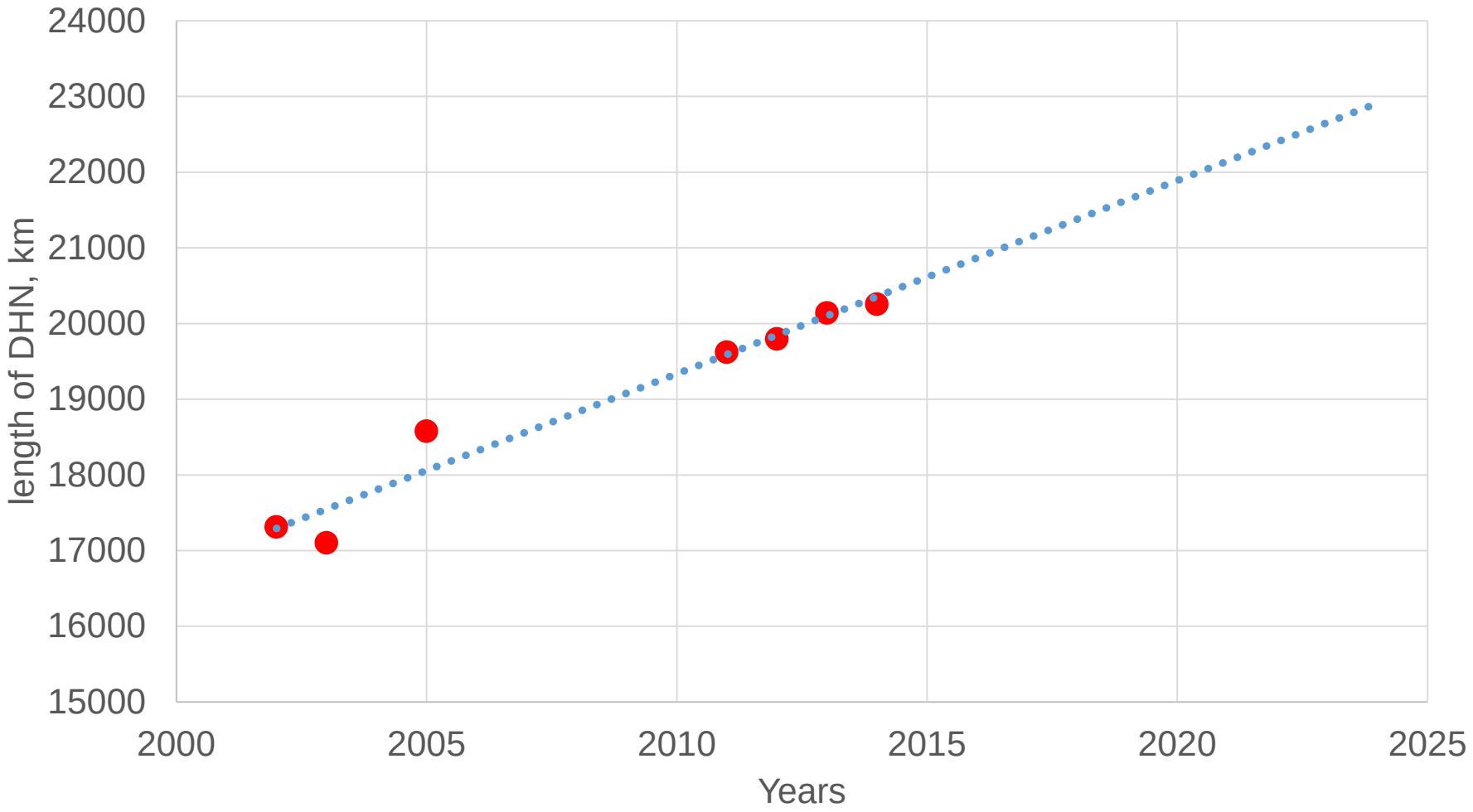
Loss of new areas (settlements)

Based on my observations

- Connection the first new heat consumers at a new areas to DHS in not profitable
- Therefore, the first investments in new areas are supplied with heat generated by individual heating systems (gas boilers
- After the connection first buildings (which are located close to the current network) to individual gas boilers, the connection of more buildings becomes unprofitable (there are located too far from the network)

To avoid this scenario, the better planning of both: heat supplying from DHS (no possibility for gas supply) and heat supplying from other heat sources should be applied

Length of DHN



Connecting Sopot (big part of city) to DHS

- GPEC (DH company in Gdańsk) decided to connect Sopot to DHS
- Sopot is health-spa resort, which faced with a significant issue: pollutions
- Ca 100 buildings
- 17 km of district heating networks
- The investment ca. 11 mln €

Summary

- The essential issues for DHC and CHP development are both a stable economic and legal frameworks and clear supporting mechanism
- For the development of district heating systems, the crucial issue is support mechanism for small-scale DHS, which will have to make a huge investments due to entry into force a MCP Directive (possibility for distributed systems)
- Currently, the unit price of heat from individual gas-fired units is so low that it does not allow for increasing the DHS heat price – at the current heat prices, the DHS are not able to develop