

PolySMART® - POLYgeneration with advanced Small and Medium scale thermally driven Air- conditioning and Refrigeration Technology

Micro-CHCP market potentials

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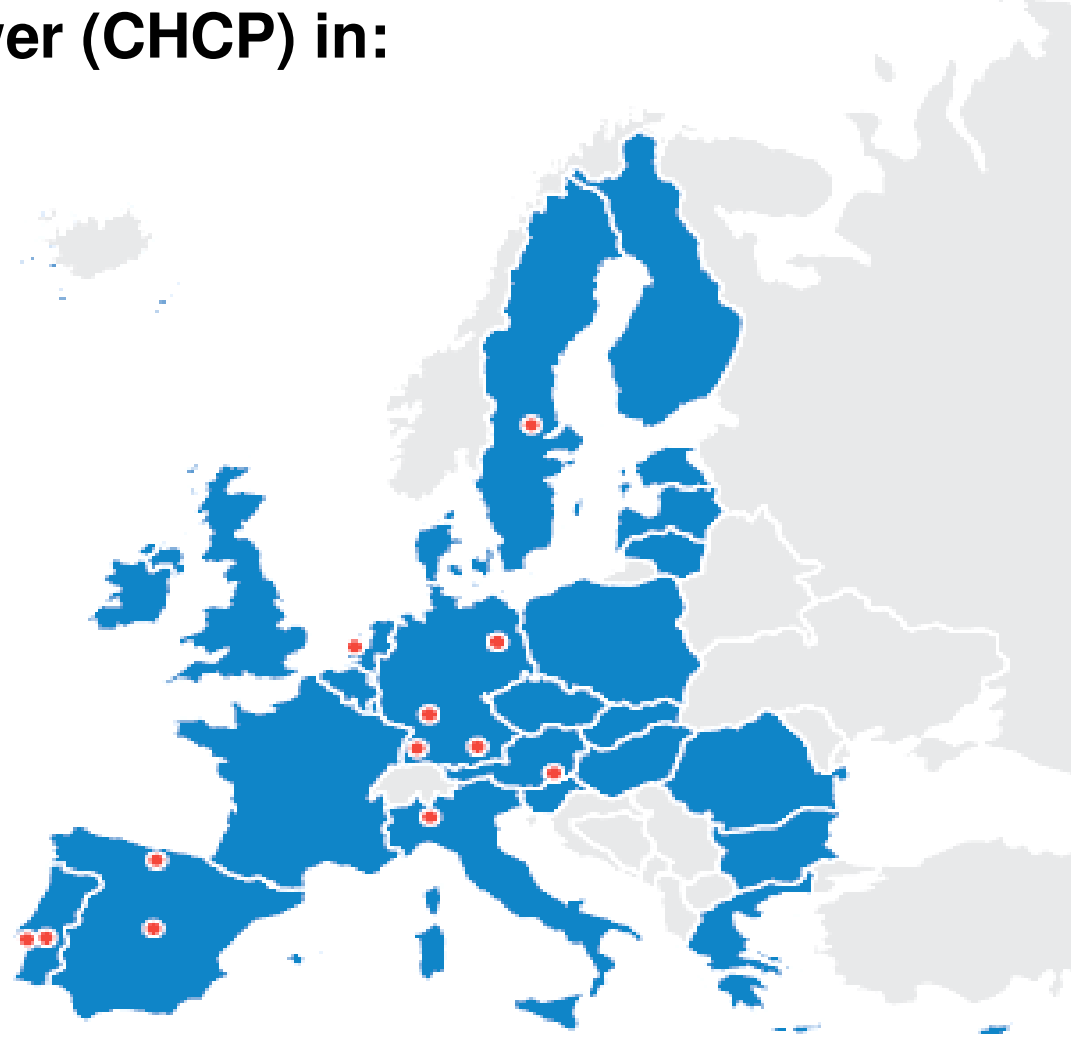
Warsaw, Jan 19th 2010



Objectives

Assess the market potential of small scale Combined Heating Cooling and Power (CHCP) in:

- Austria,
- Czech Republic,
- Germany,
- Italy,
- Netherlands,
- Poland,
- Portugal,
- Spain,
- Sweden
- and Switzerland.



■ Heating & Cooling in Europe

➤ The demand side

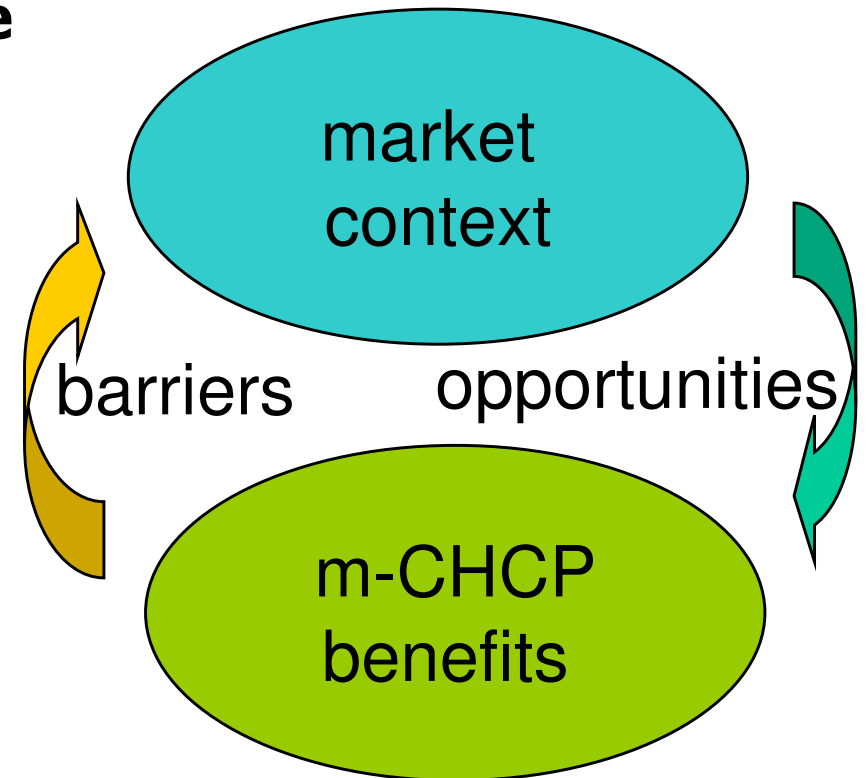
➤ The supply side

■ Micro-CHCP opportunities

Cross country analysis

Financial Simulations

■ Barriers to diffusion



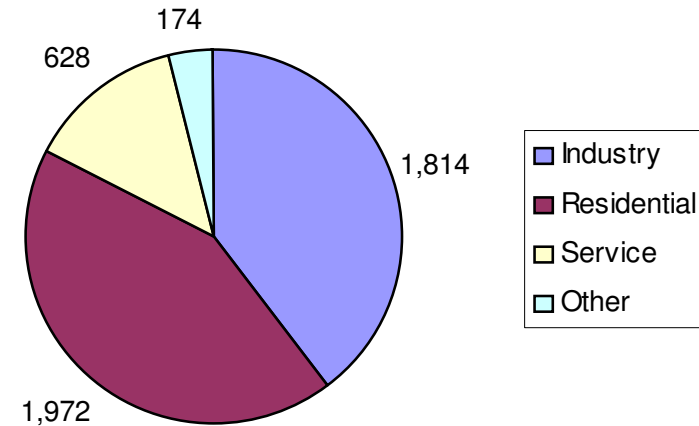
The demand for H&C

> Demand in EU15

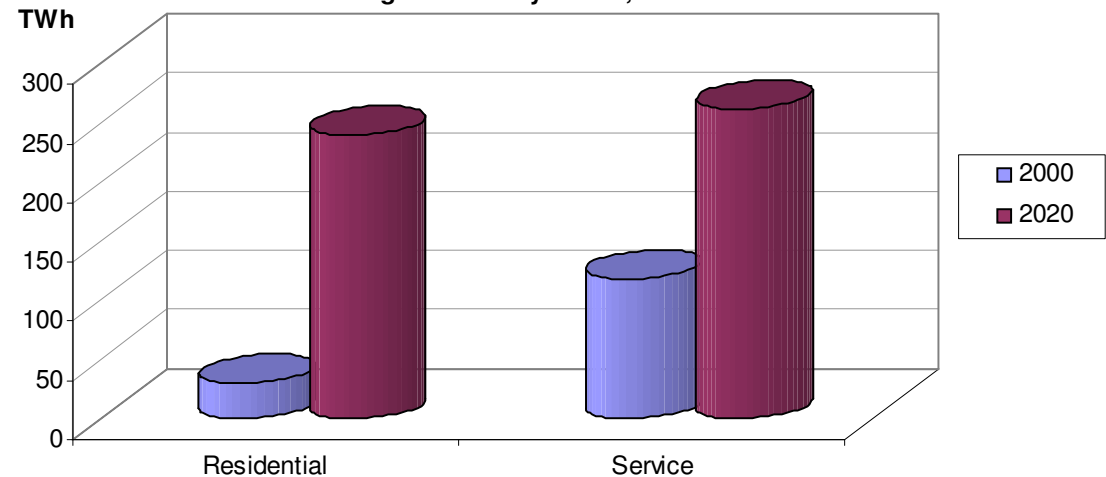
- **Residential and Service account more than 50% of total heat demand**
- **Cooling saturation level is low: 5% for residential, 27% for service**
- **Cooling saturation level in 2020: 40% for residential, 60% for service**

Source: EcoHeatCool, 2006

Heat demand in EU15, TWh by sector



Cooling demand by sector, 2000 - 2020



The demand for H&C

> Supply in EU15

- Heating market saturated (slow growth, replacements)
- Cooling market in expansion (saturation in 2020, new installations)

■ Energy efficient solutions

	unit sold
➤ Condensing boilers and inverter RAC	x,000,000
➤ Heat Pumps	x00,000
➤ Central air conditioning systems	x0,000
➤ micro-CHP (1-50 kWe)	x,000

■ Large CHP plants

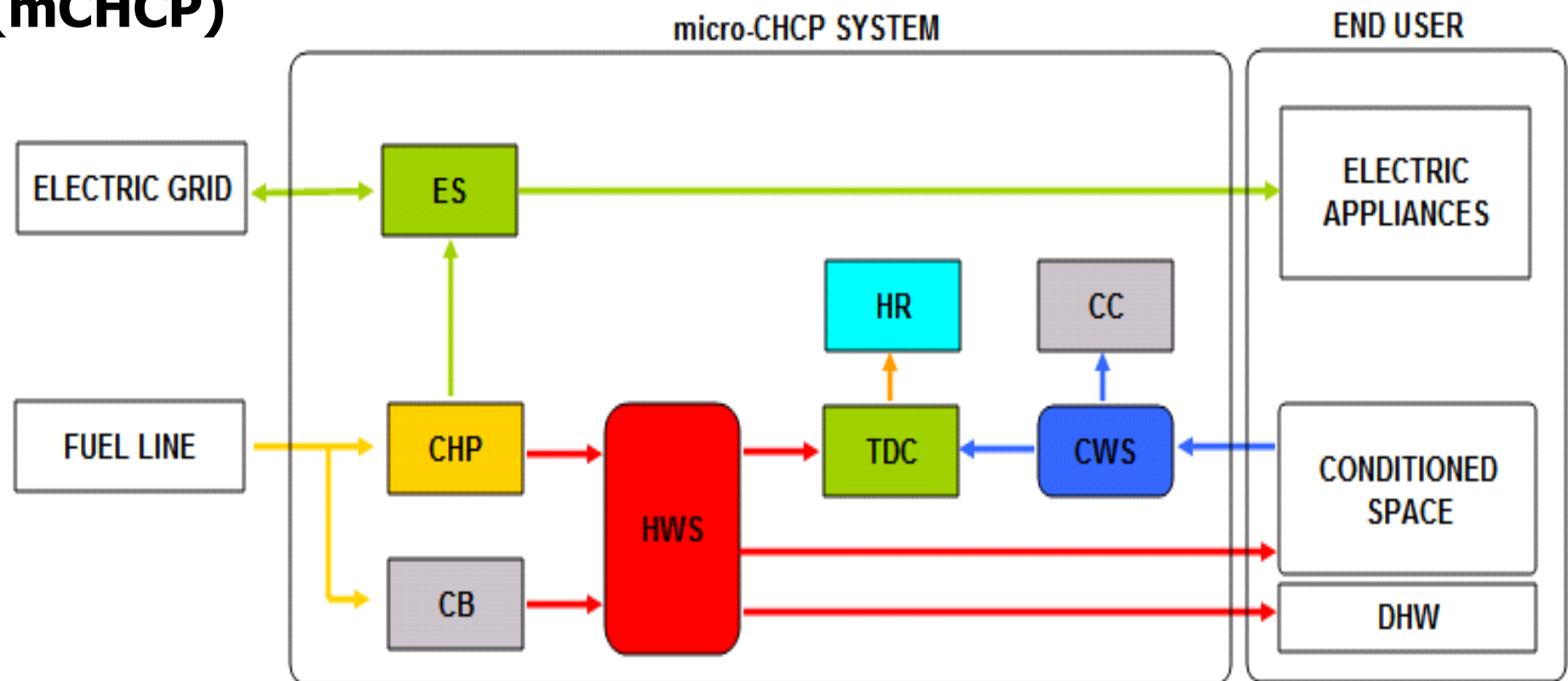
- shares of 20-40% of heating demand in CZ, SW, PL



Micro-CHCP opportunities

> models in PolySMART

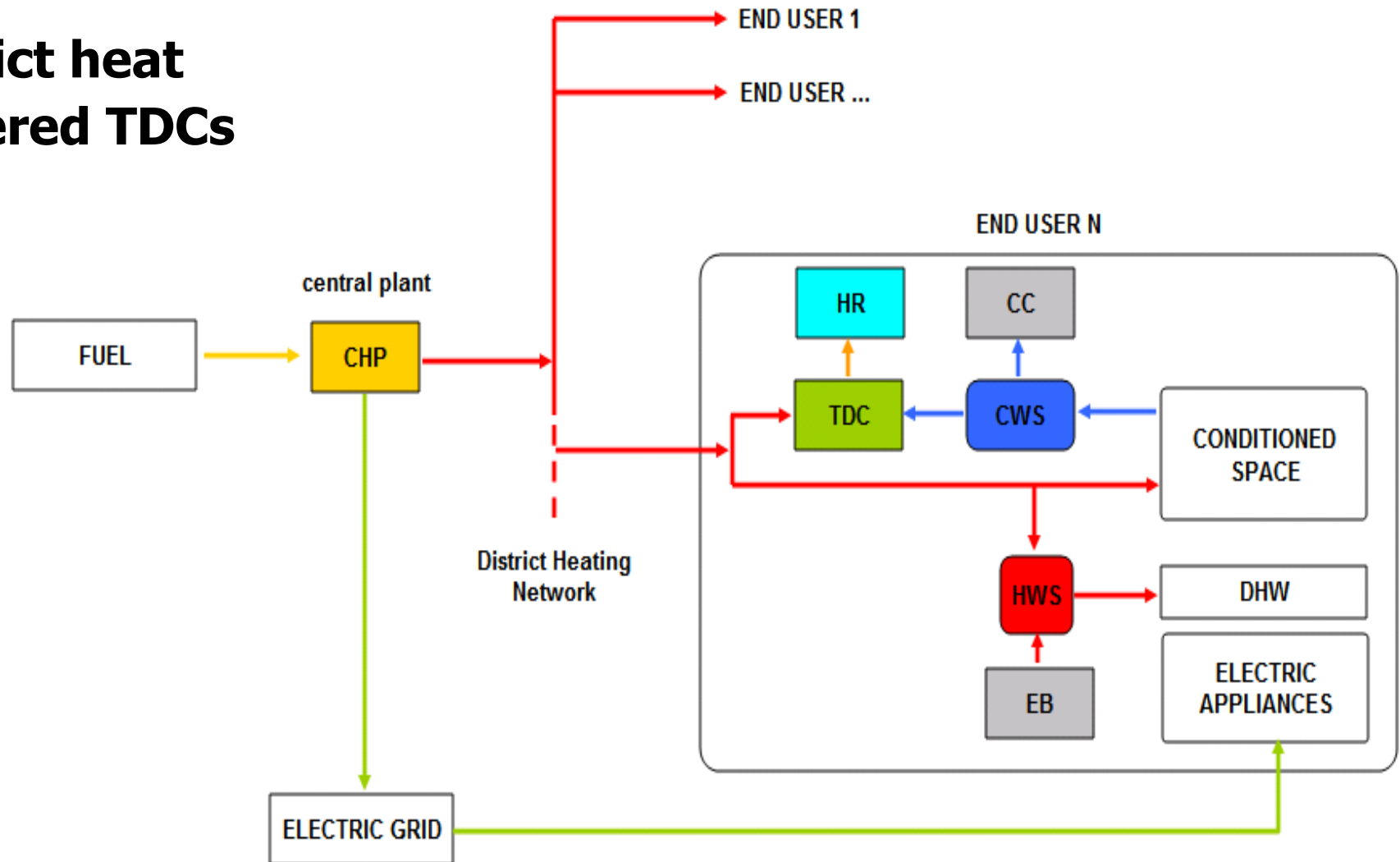
■ Distributed mCHP and mTDC (mCHCP)



Micro-CHCP opportunities

> models in PolySMART

■ District heat powered TDCs



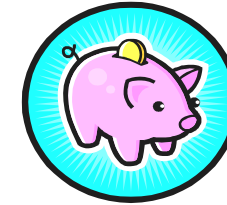
Economic attractiveness of micro-CHCP

Primary Energy Savings

&

Gross Financial Savings

(+ associated saved CO2 emissions)



- Inherent electricity savings in CHCP compensate for extra fuel consumption and extra costs (fuel, maintenance & investment).
- Incentives are key in feasibility scenarios
- Other benefits: on site power generation, alleviating electric grid peaks / failures

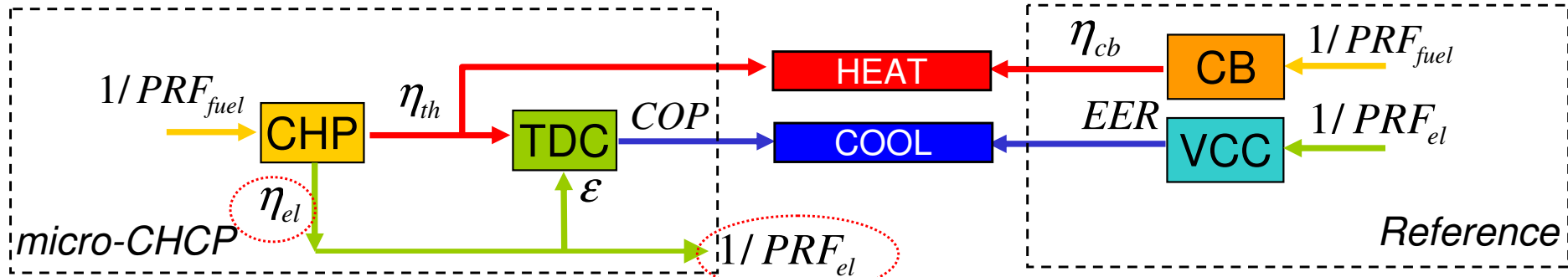


The potential of mCHCP - Primary energy savings

micro-CHCP

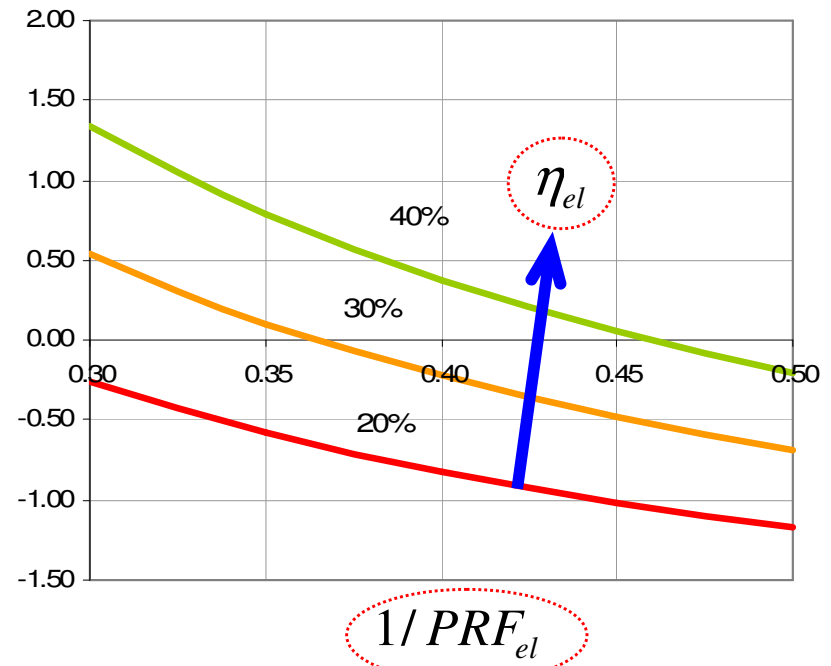
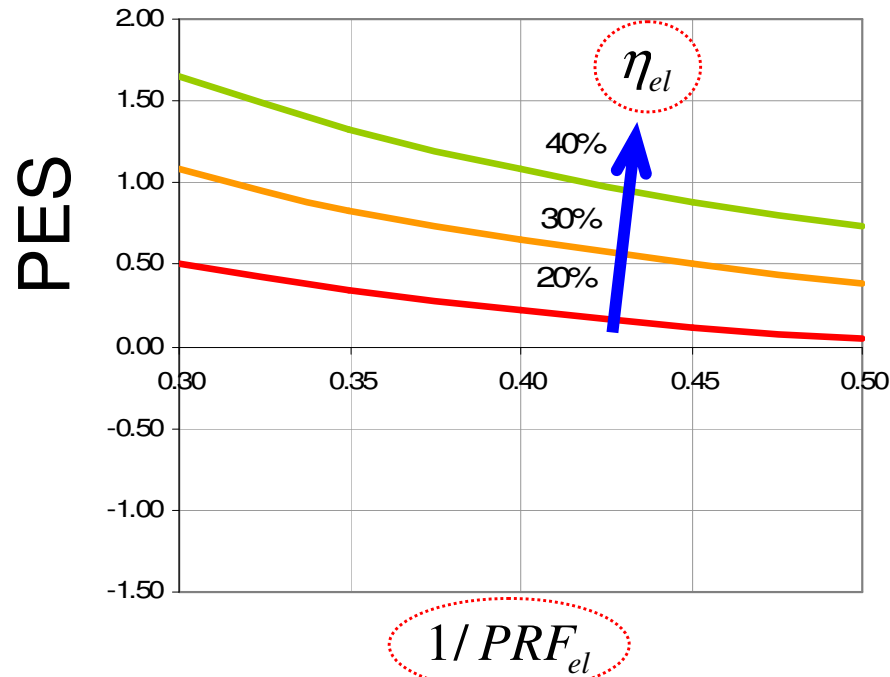
Vs

reference

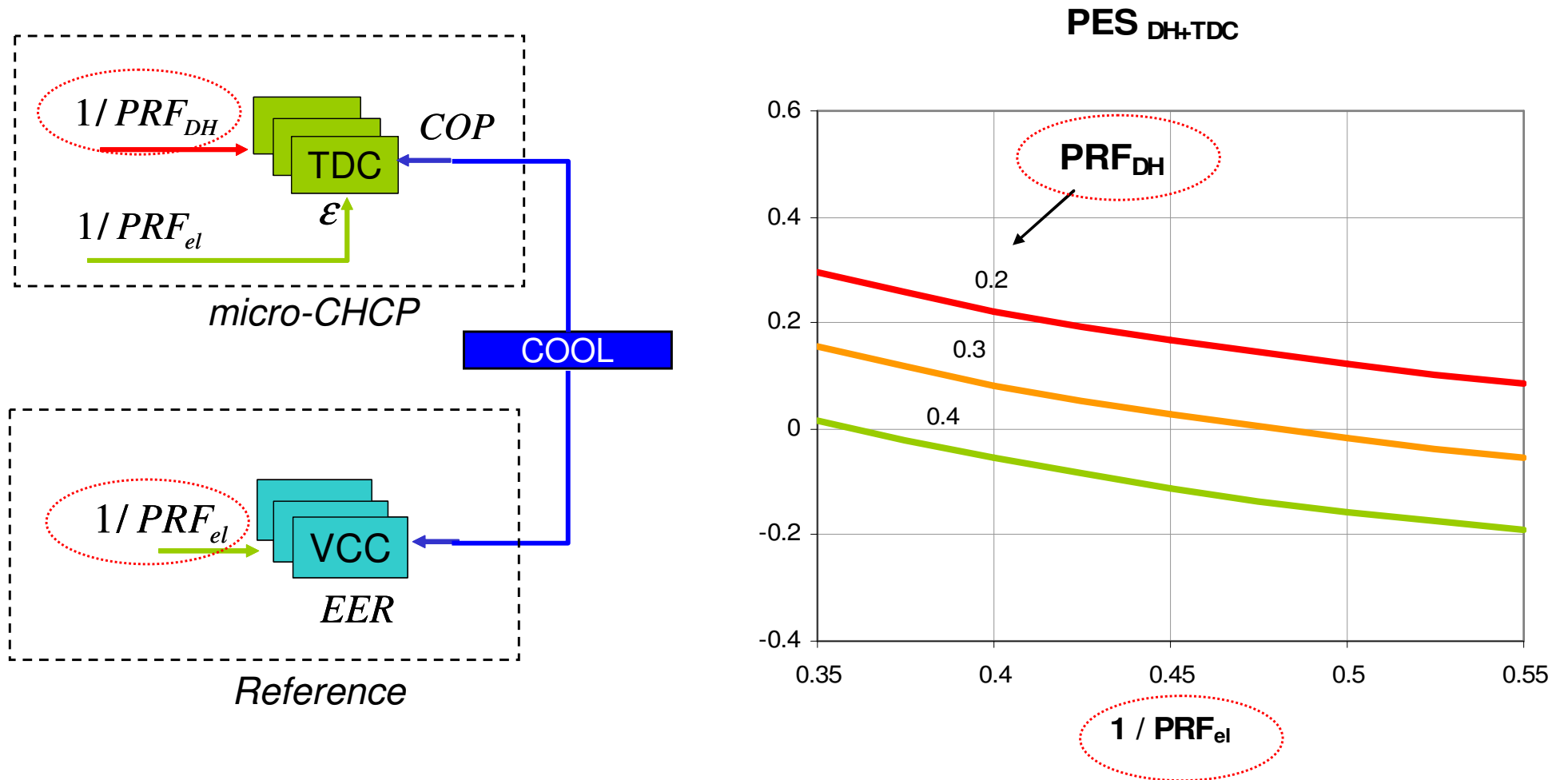


100% HEAT

100% COOL



The potential of mCHCP - Primary energy savings district heat powered TDCs Vs reference



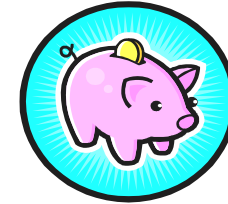
The potential of mCHCP – Financial savings

> Gross margin

GROSS MARGIN = + revenues – variable costs

■ micro CHCP Vs reference

- + savings on electricity purchase for cooling
- + savings on fuel purchase for heating



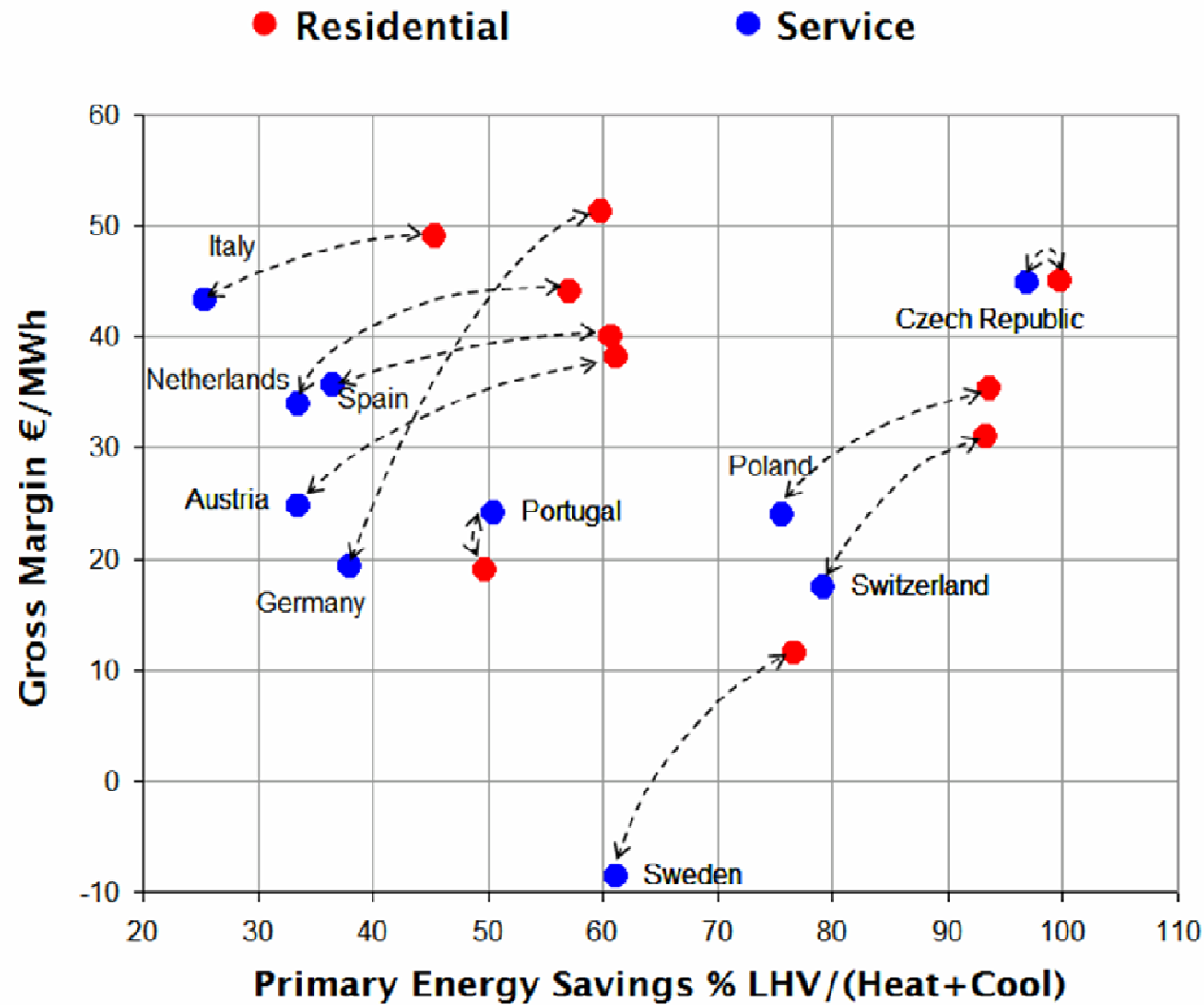
■ micro CHCP

- + electricity generation (savings on purchase, revenues from sale)
- cost of fuel used by the CHCP
- cost of electricity used by the CHCP (e.g., TDC parasitic)

■ Incentives (fuel tax exemption, feed-in tariff, white certificates, green certificates)



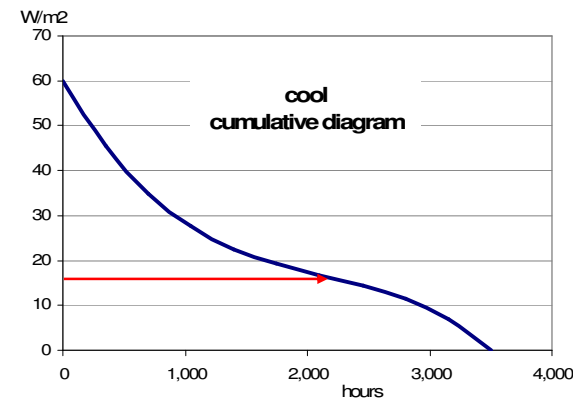
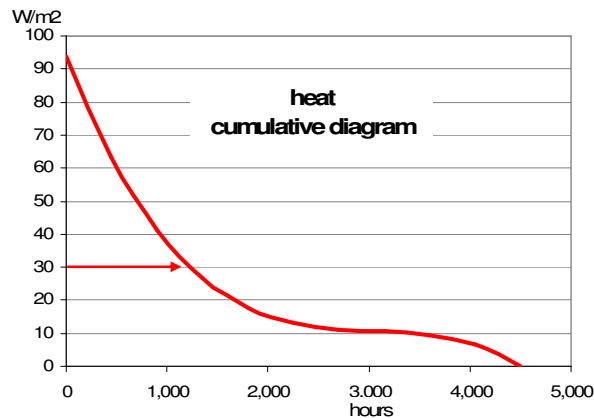
The potential of mCHCP – Cross country analysis



The potential of mCHCP

> Financial viability

- **Peak load design** → operation hours are too low
- **Base load design** → micro-CHCP + backup heater + backup chiller: operation hours increased / good fraction of the energy demand can be satisfied.



- **Optimal sizing: what fraction of heating and cooling can be covered by CHCP in the best economical way? → Feasibility studies**



The potential of micro-CHCP

> Financial viability

Applications:

- Hotels
- Hospitals
- Office buildings
- Residences

Countries:

- Germany
- Italy
- Poland
- Spain
- Switzerland

Focus:

- Neutral gas
- Incentives
- Climate
- Building size
- Building efficiency class



The potential of micro-CHCP

> Financial viability

	Italy	Spain	Poland	Germany	Switzerland
Sector	Hotels	Residential	Hospitals	Offices	Offices
Application Size	3 and 4 star 25 - 50 - 100 rooms 5 locations	1 - N family house high & low insulation 4 locations	200,500,800 beds 5 locations	2,000, 4,000, 8,000, 16,000 m2 1 location	2400 m2 high efficiency
Best application	North - Business 50 rooms (3-4 star)	Madrid climate Multi-family house Low insulation	50-200 beds all locations	8,000 m2 less insulated higher electrical loads	-
PES (%)					
- Max	25-35%	15-25%	20%	20%	12%(UCTE Mix)
- Optimal	10-15%	10-15%	10%	10%	0% (Swiss Mix)
Demand coverage	50-75% heating 50-75% cooling	60-80% heating 20-30% cooling	40% heating 15-20% cooling	25% heating 30% cooling	-
Best CHCP size	20-50 kW _e 30-80 kW _t 15-35 kW _c	20-50 kW _e 30-80 kW _t 15-35 kW _c	20-50 kW _e 30-80 kW _t 15-35 kW _c	15 kW _e 30 kW _t 15 kW _c	7.5 kW _e 30 kW _t 15 kW _c
Financials					
- BAU	Reasonable	Poor	Neutral	Neutral	-
- Support	Good	Neutral	Reasonable	Reasonable	-

Poor: NPV < 0 Neutral: NPV=0 Reasonable: PB < 10 Good: PB < 5



The potential of micro-CHCP

> Barriers

■ Technical

- TDC drive temperature is low (e.g. 75 °C)
- microCHP electric efficiency higher than 30% (mainly IC engine)
- grid capacity, short-circuits power, safety, protection

■ Political

- feed-in tariff is the most important economical barrier
- energy price volatility and utilities liberalization

■ Enviromental

- emissions (CO, NOx), for which some regulatory barrier may arise in critical areas



Conclusions

- **m-CHCP prospective customers could be preferably found among:**
 - **Medium size hotels (< 200 rooms)**
 - **Small hospitals (< 200 beds)**
 - **Office buildings (< 4,000 m²)**
- **Natural gas: primary energy savings (10 ÷ 20%) achievable when CHP electric efficiency > 30 %**
- **Base load design can lead to financial savings (PB = 5 ÷ 10 years) with political support (i.e. incentives)**
- **Share of heating and cooling demand satisfied by the m-CHCP plant: heating 25-80%, cooling 15-75%**



Thank you for your attention!

