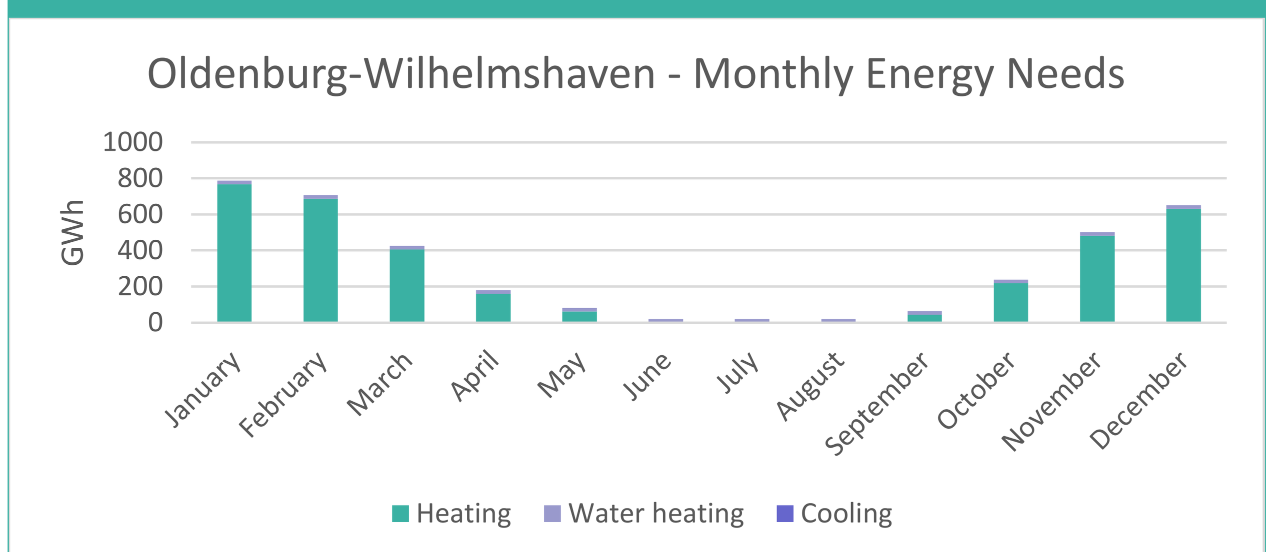
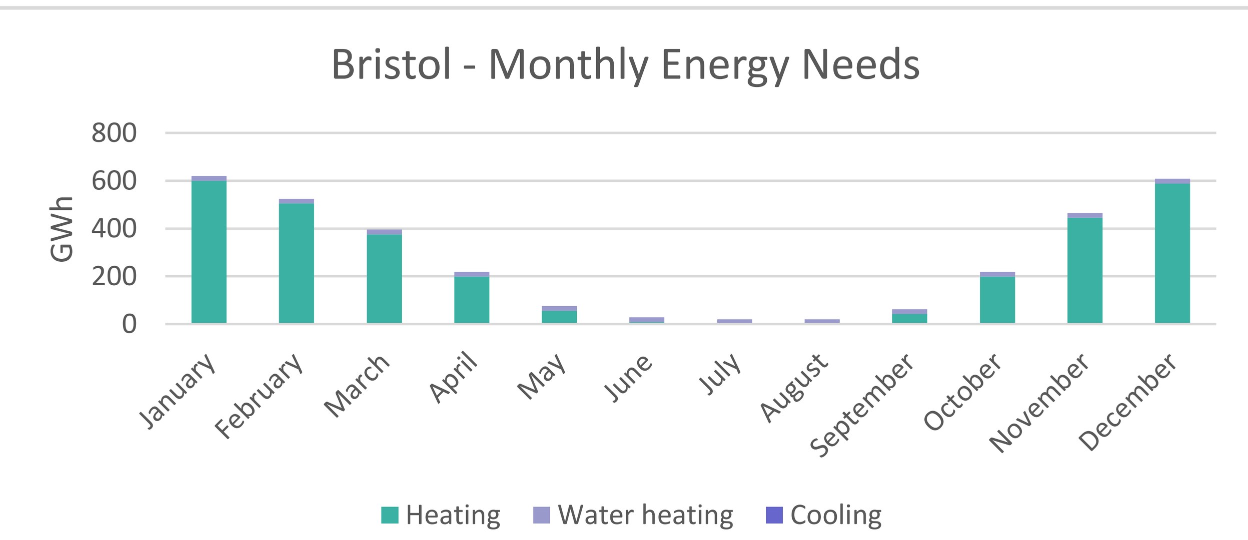
SET PLAN 2015

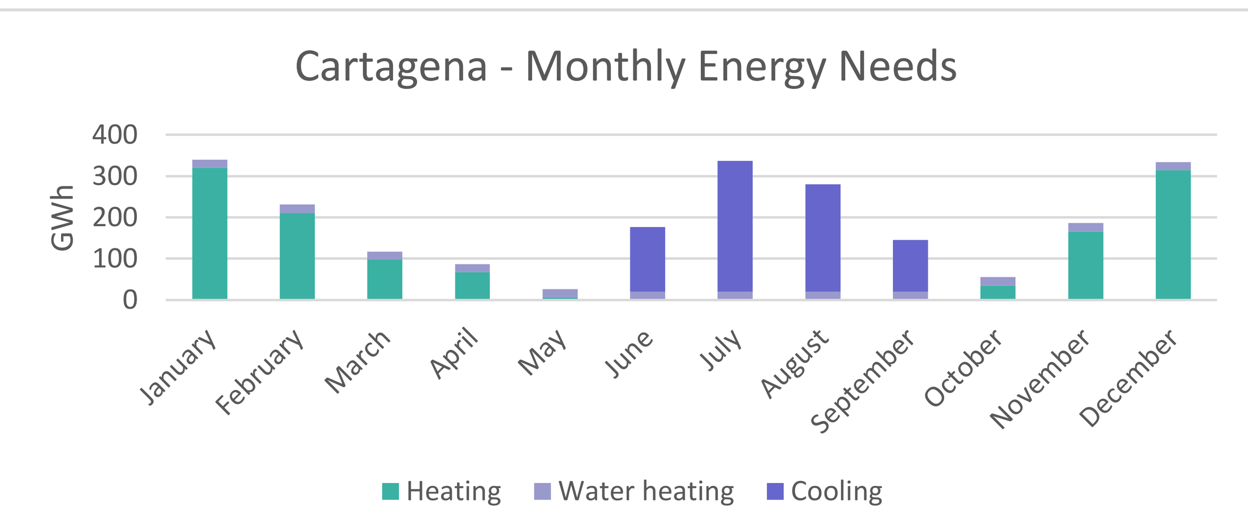
Cost of Using the Waste Heat from CHP Plants in Low-Temperature DH Networks

Assessing the cost of three district heating schemes that respectively represent typical weather conditions in northern, central, and southern Europe (Oldenburg-Wilhelmshaven, Bristol and Cartagena), it has been possible to appreciate the potential reduction in expenditure as a result of both converting existing conventional thermal generating stations into cogeneration plants as well as investing in a low-temperature heating and cooling infrastructure (the latter only feasible for the weather conditions in southern Europe).

The implemented method (which considers as main elements the power plant and the needed energy to provide hot water, heating, and cooling to a specific number of loads) that sustains the economic analysis conducted for three cities of the EU-28 with different weather conditions constitutes a valuable element in itself because not using specific software and using simple and immediate calculations allows the evaluation of the potential benefits of retrofitting existing power plants into cogeneration plants with an associated heating network infrastructure (and, in the case of Cartagena, also with a cooling one), being, therefore, particularly suitable for studies with analogous purposes.







CASE STUDIES

COGEN-a1 Case

In this case, the conventional thermal power plants have been considered as converted into cogeneration plants through their conversion and not through the construction of completely new plants; the investment associated with the infrastructure necessary to enable the implementation of low-temperature district heating networks has also been taken into account. Unlike COGEN-b and COGEN-c, cooling is carried out through electrical refrigeration equipment.

COGEN-a2 Case

The COGEN-a2 case is similar to COGEN-a1, but building a new cogeneration plant instead of converting the conventional thermal power station.

COGEN-b Case

Unlike the case COGEN-a1, COGEN-b assumes (individual) absorption units use the district heating network for cooling.

COGEN-c Case (trigeneration)

Unlike the cases COGEN-a1-a2, in COGEN-c, it is assumed that the cooling is obtained through a district heating network and integrated absorption chillers (which refrigerate the district energy scheme utilising the cogeneration waste heat). It is assumed that absorption units are located between the transmission pipelines and the district heating networks of the cities.

CONCLUSIONS

1

From the conducted evaluation, it was found that, in case of deciding to convert the conventional thermal plants studied into cogeneration plants, investing in the necessary infrastructure associated and supposing that the discount rate is in line with the proposal by the EU Directorate-General for Regional and Urban Policy, yearly expenses for the power plants located in Oldenburg-Wilhelmshaven, Bristol, and Cartagena would decrease by 215, 89, and 192 million euros respectively, making this technology a highly attractive option from an energy, economic and environmental perspective.

2

It was concluded that, in case of using different discount rates to 3.5% (the one proposed by the Directorate General of Urban and Regional Policy of the EU), the feasibility of projects involving joint use of cogeneration plants and district heating networks will be greatly diminished, being the maintaining of the aforementioned discount rate of capital importance if EU-28 Member States aim to have the safe, clean, and efficient energy enacted by one of the three priorities (in particular, by the Societal Challenges) of the Horizon 2020 of the EU-28

	Oldenburg-Wilhelmshaven	Bristol	Cartagena	Unit
Rated power of the cogeneration plant	757	1140	1200	MW
Thermal power cogeneration plant	931	878	923	MWt
Peak demand covered by the CHP	50%	50%	70%	
Losses during peak demand in winter	6%	6%	6%	
Demand during peak hour in the coldest month	8.7 26.2	8.7 26.2	6.1 18.5	kW/dwelling kW other consumers
Consumers	115.1 28.4	108.5 27.1	115.0 29.0	Dwellings (thousands) Other consumers (thousands)
Demand for heating and HW per unit area per year	185 250	160 215	70 95	$kWh/m^2/year$ (dwellings) $kWh/m^2/year$ (other consumers)
Cooling load per unit area per year	-	-	48	$kWh/m^2/year$
Annual demand for heating and HW	3691	3258	1411	GWh
Annual cooling demand	-	-	859	GWh

Power plant	Type	Fuel	Rated power [MW]
Wilhelmshaven-E.ON	Steam turbine	Coal	757 (1 x 757 MW)
Seabank (Bristol)	Gas turbine combined cycle	Natural gas	1140 (1 x 755 MW + 1 x 385 MW)
El Fangal (Cartagena)	Gas turbine combined cycle	Natural gas	1200 (3 x 400 MW)

Enrique Rosales-Asensio

Phd Student at UNED