MINISTRY OF ENERGY, COMMERCE, INDUSTRY AND TOURISM

COMPREHENSIVE ASSESSMENTS ACCORDING TO ARTICLE 14 OF EED

THE CYPRUS CASE

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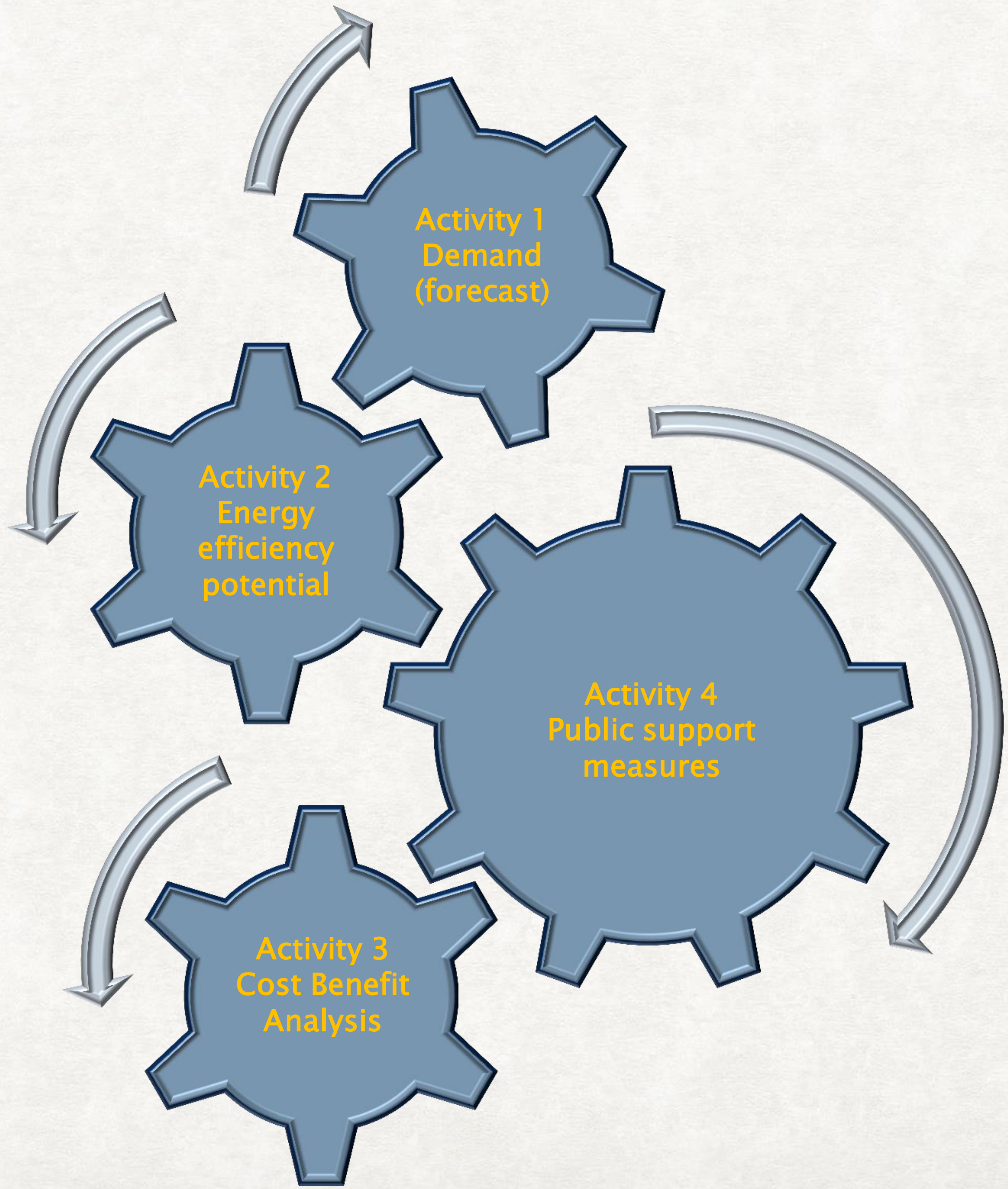
CA EED PARALLEL WORKSHOPS
7-8 March - Munich

PROJECT INTRODUCTION

The study (project) was carried out by the Joint Research Centre (JRC) and the project duration was 13 months (February 2015 – March 2016).

The study is divided into four activities which are tightly interlinked and correlated, with a view to perform an integrated assessment of the potential for the application of high efficiency cogeneration and efficient district heating and cooling.

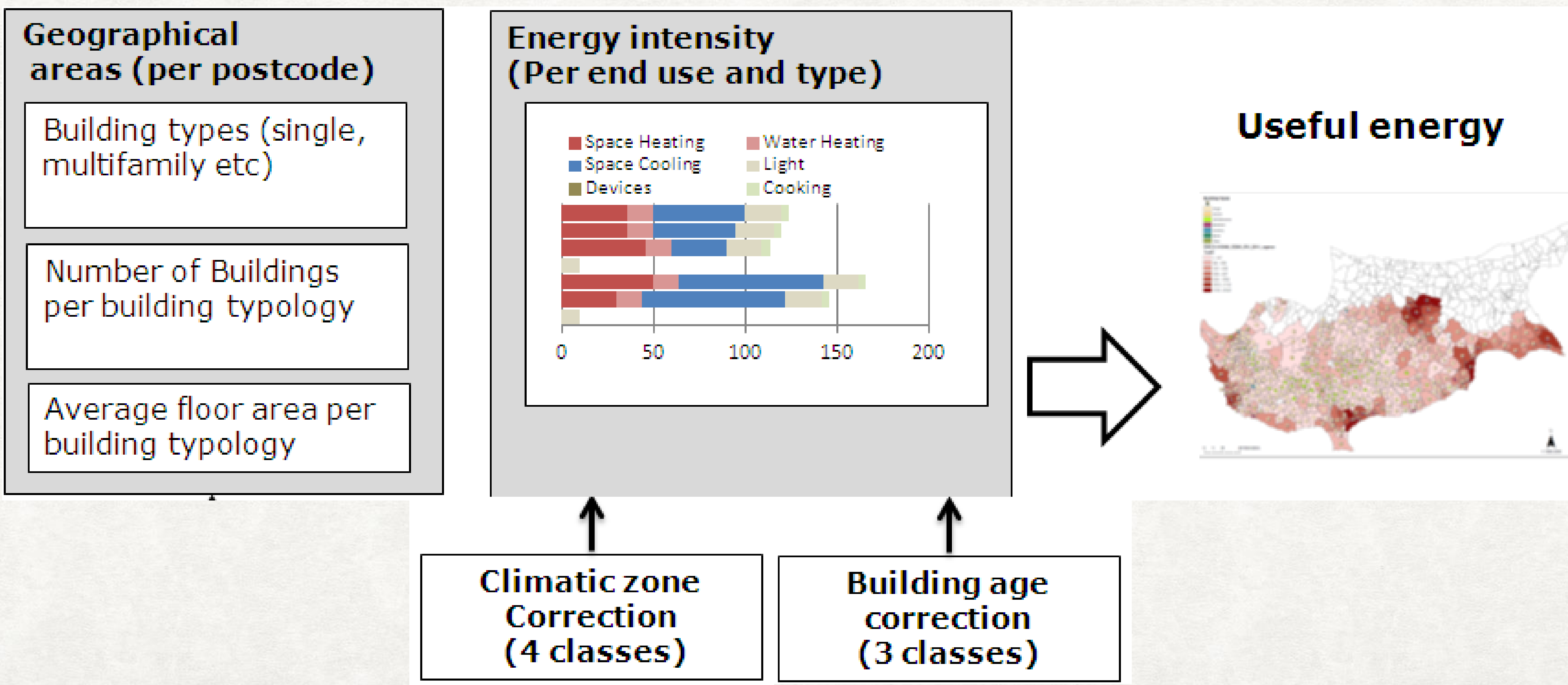


ACTIVITY 1: HEATING AND COOLING DEMAND DESCRIPTION

This activity was aimed identifying the demand for heating and cooling purposes for the main economic sectors including a quantitative forecast and a heat map.

Residential Sector

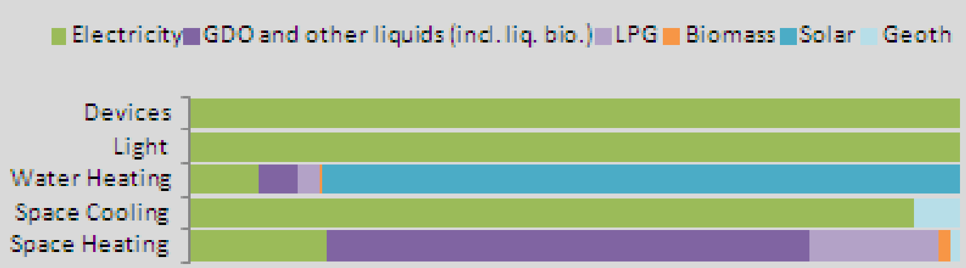
The energy consumption in each postal code area was derived as follows:



ACTIVITY 1: HEATING AND COOLING DEMAND DESCRIPTION

Useful energy

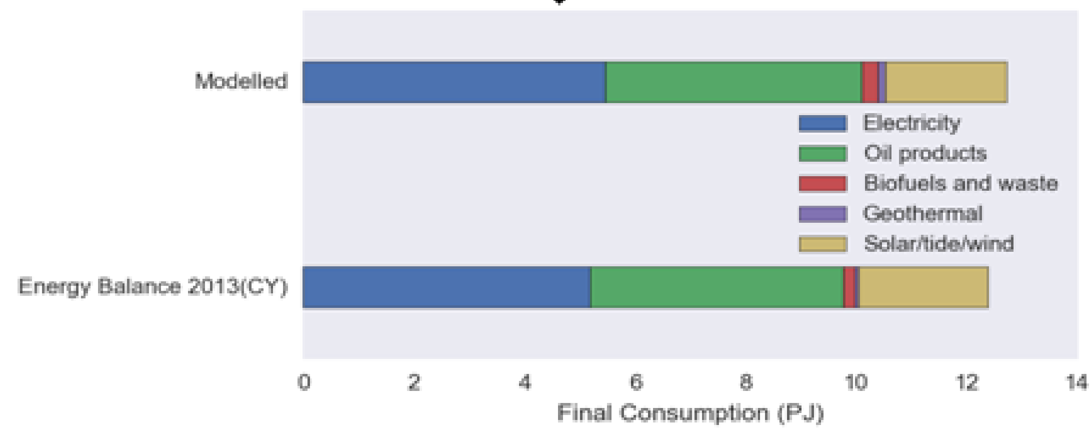
Fuel shares on useful energy

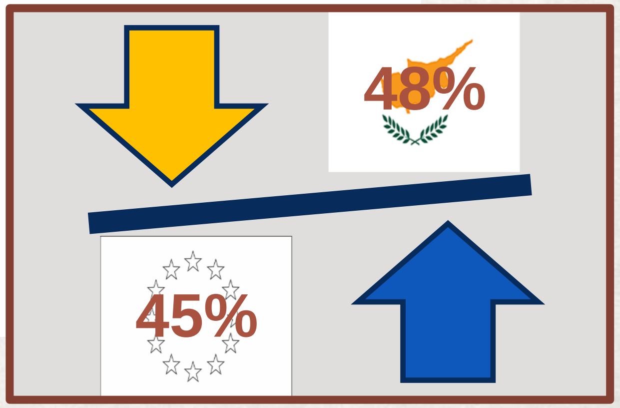


Conversion factors

	Electricity	GDO and other liquids	LPG	Biomass	Solar	Geothermal
Space Heating	2	0.85	0.8	0.7	0.95	3
Space Cooling	3.2					3.2
Water Heating	0.99	0.75	0.75	0.7	0.82	
Light and Devices	0.95					
Cooking	0.75		0.6	0.3		

Final energy

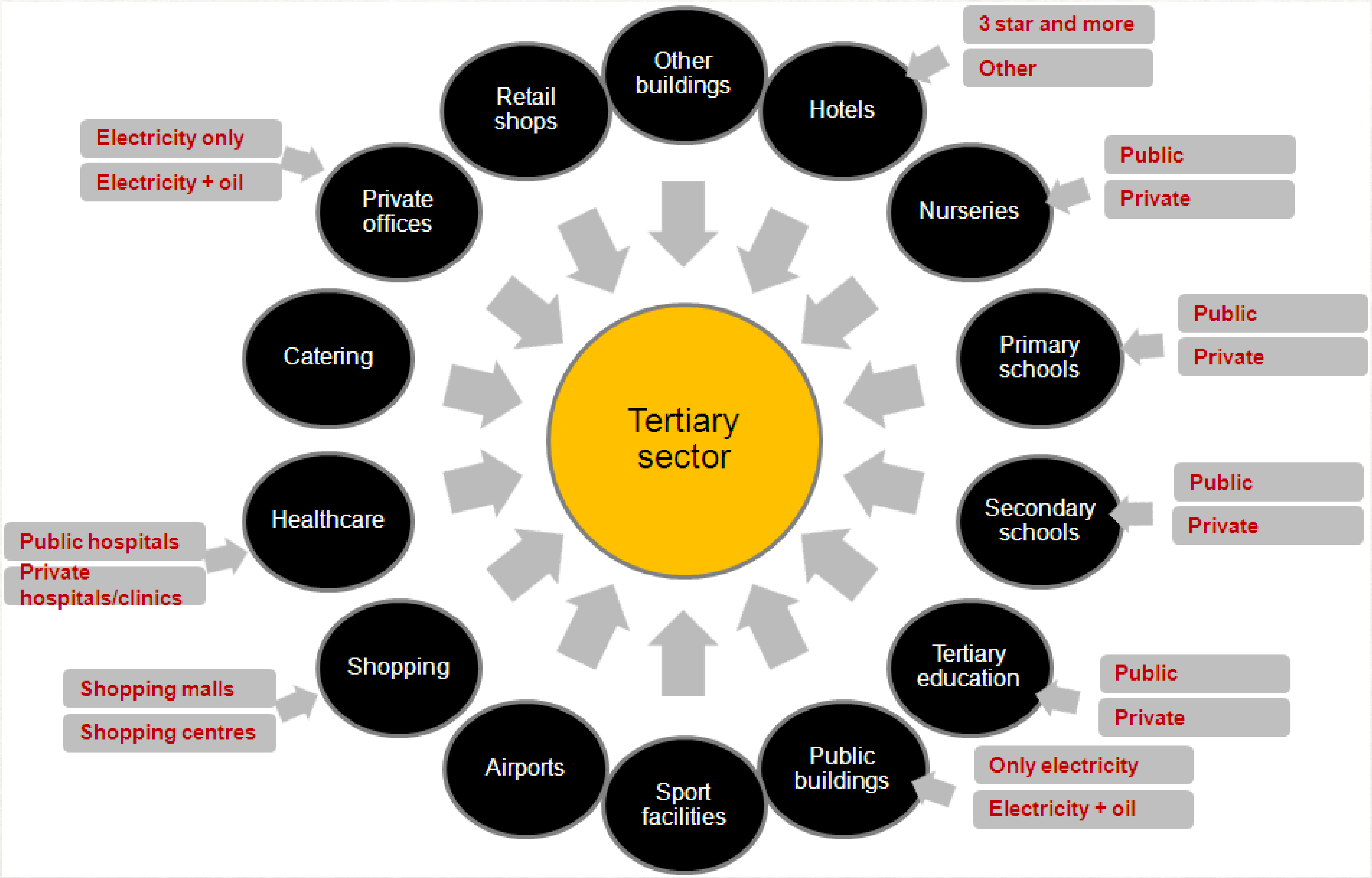




ACTIVITY 1: HEATING AND COOLING DEMAND DESCRIPTION

Tertiary Sector

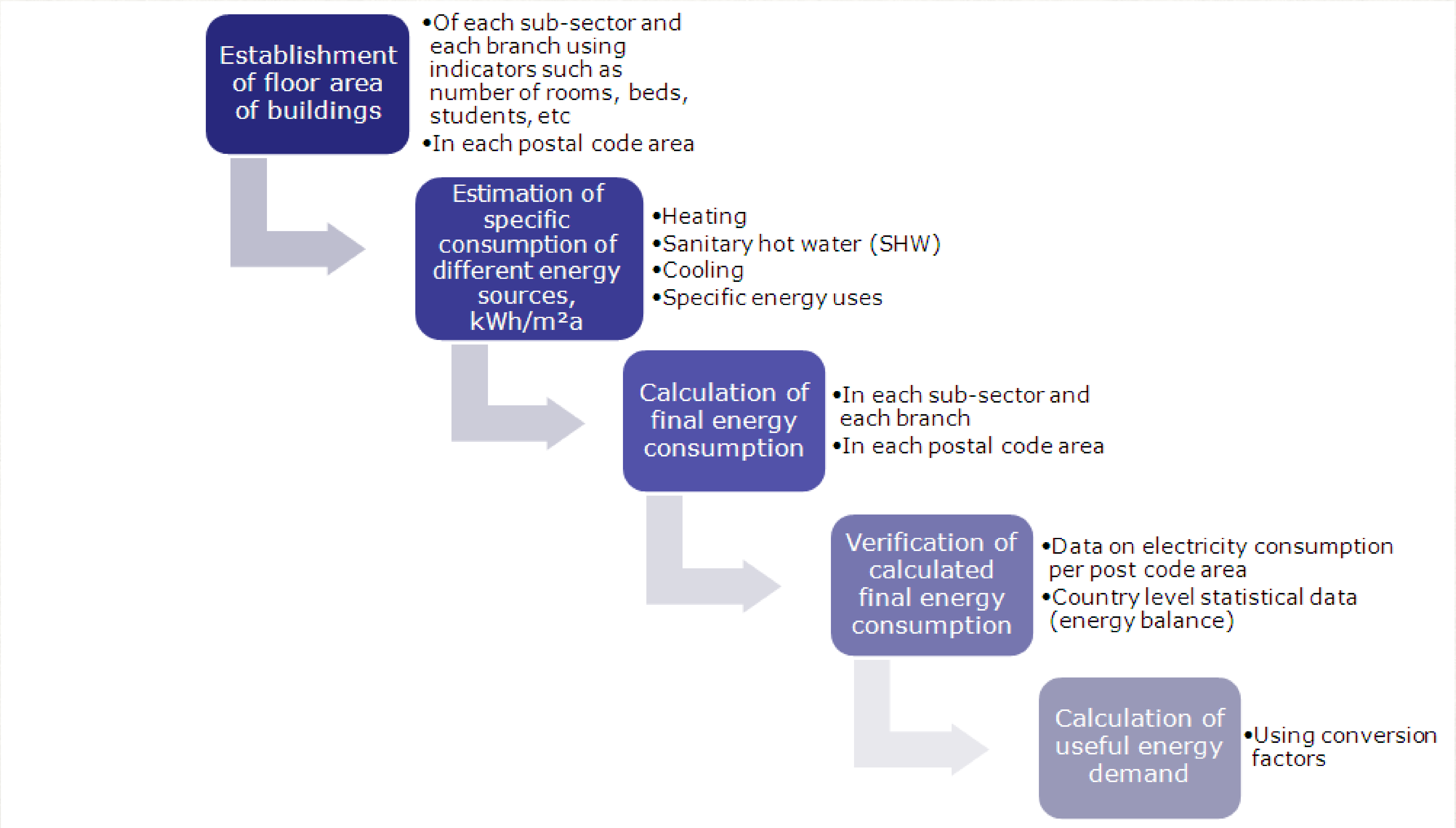
The type of tertiary buildings analysed in this study are as follows,



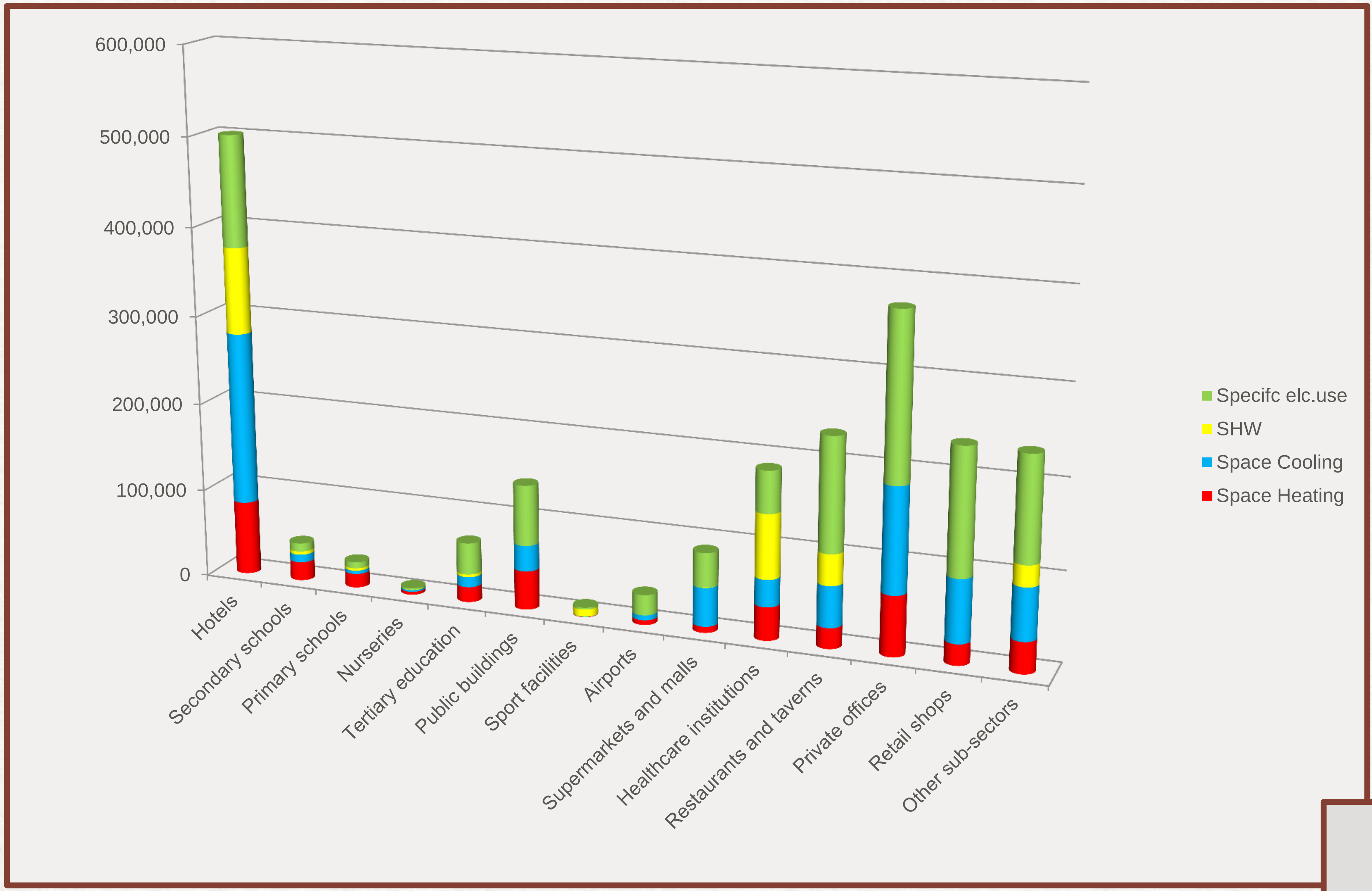
ACTIVITY 1: HEATING AND COOLING DEMAND DESCRIPTION

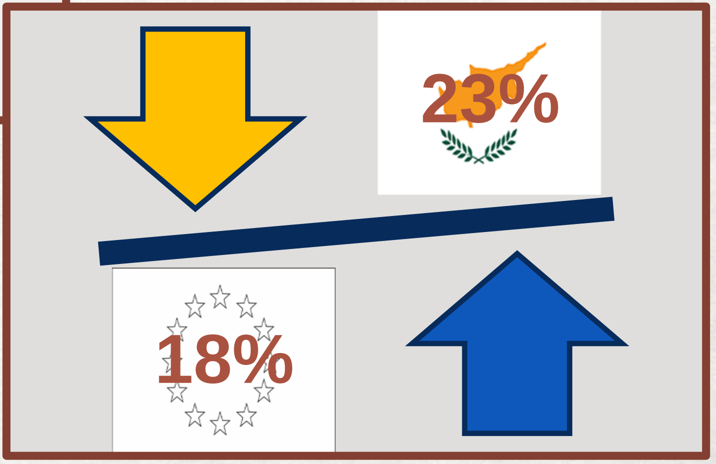
Tertiary Sector

The energy consumption in each postal code area for each sub-sector was derived following the procedure as follows:



ACTIVITY 1: HEATING AND COOLING DEMAND DESCRIPTION

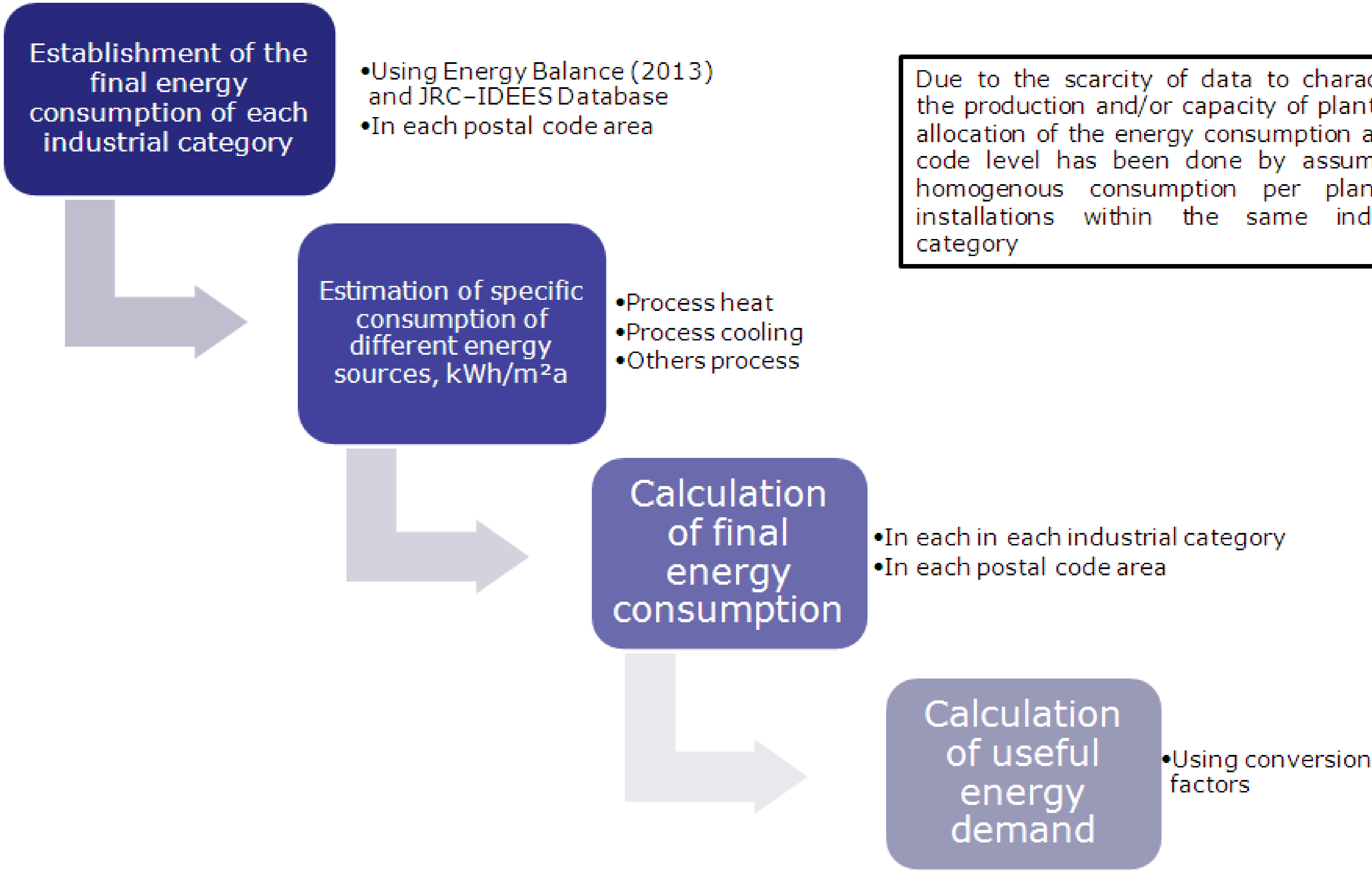




ACTIVITY 1: HEATING AND COOLING DEMAND DESCRIPTION

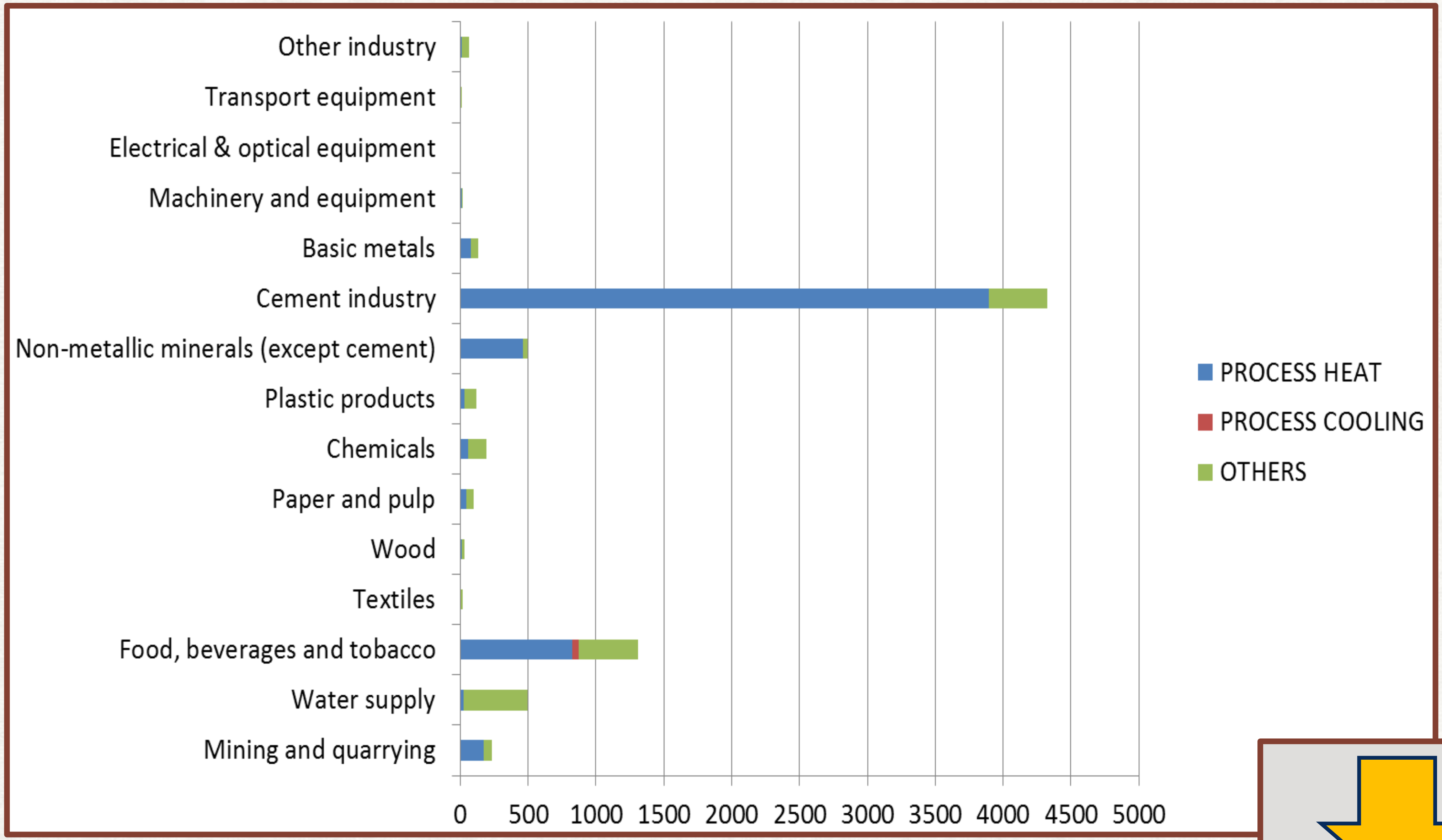
Industrial Sector

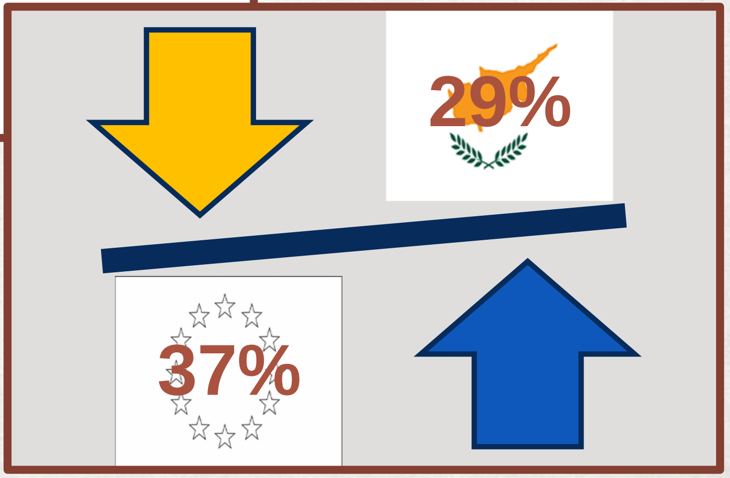
The energy consumption in each postal code area for each industrial category was derived following the procedure as follows:



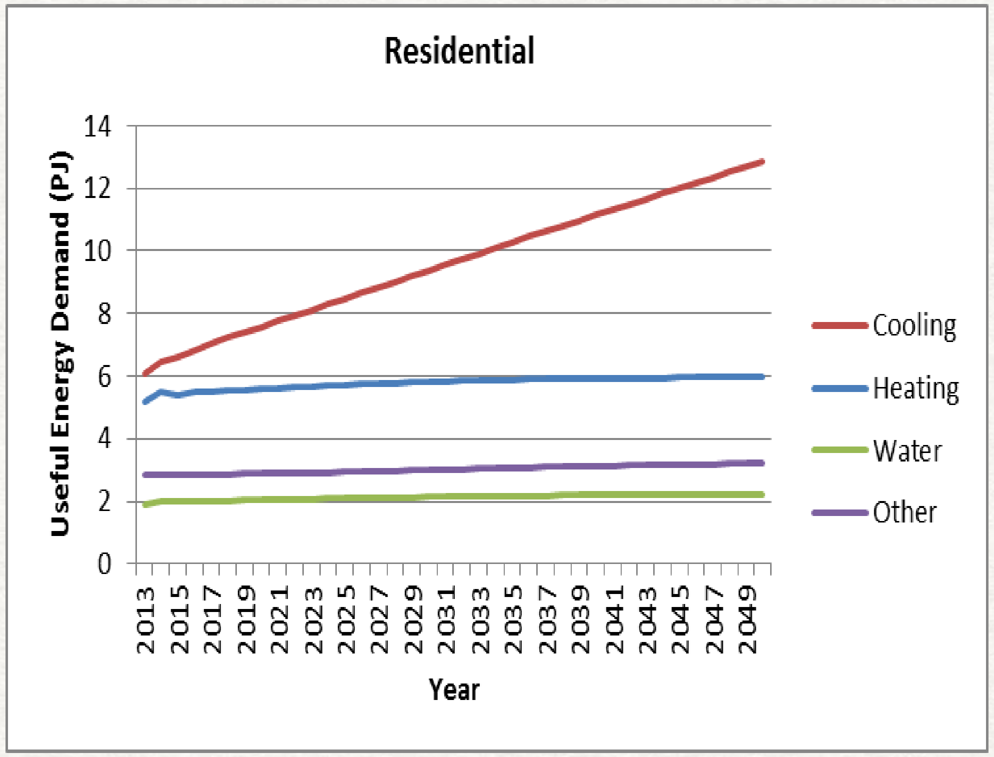
Due to the scarcity of data to characterise the production and/or capacity of plants, the allocation of the energy consumption at post code level has been done by assuming a homogenous consumption per plant for installations within the same industrial category

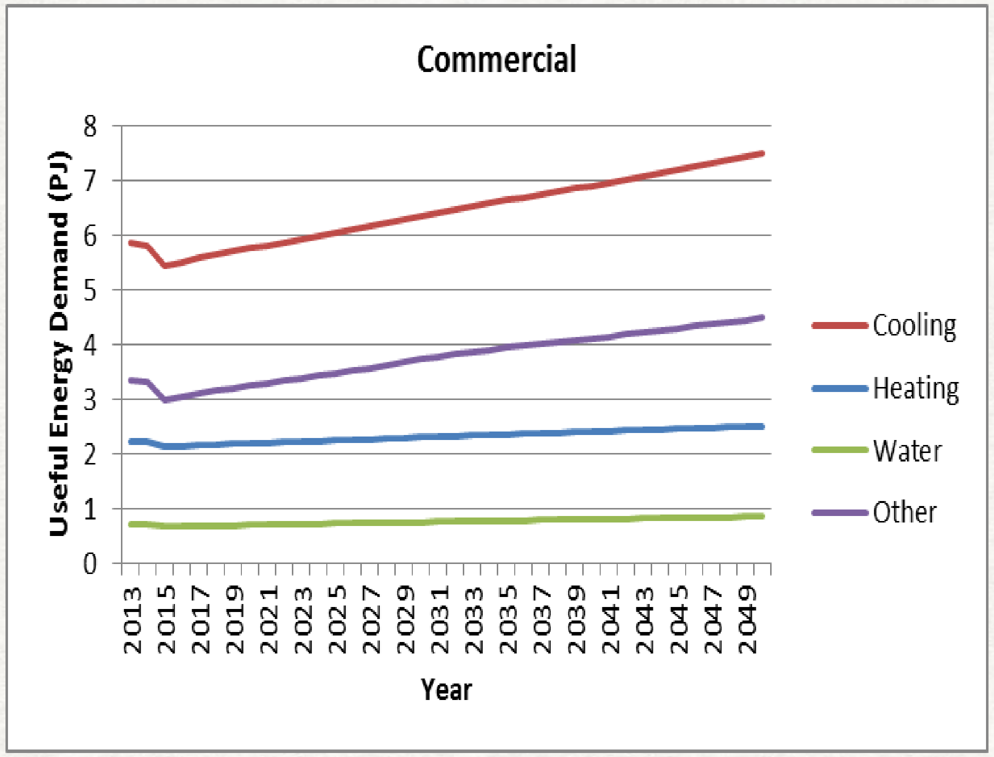
ACTIVITY 1: HEATING AND COOLING DEMAND DESCRIPTION

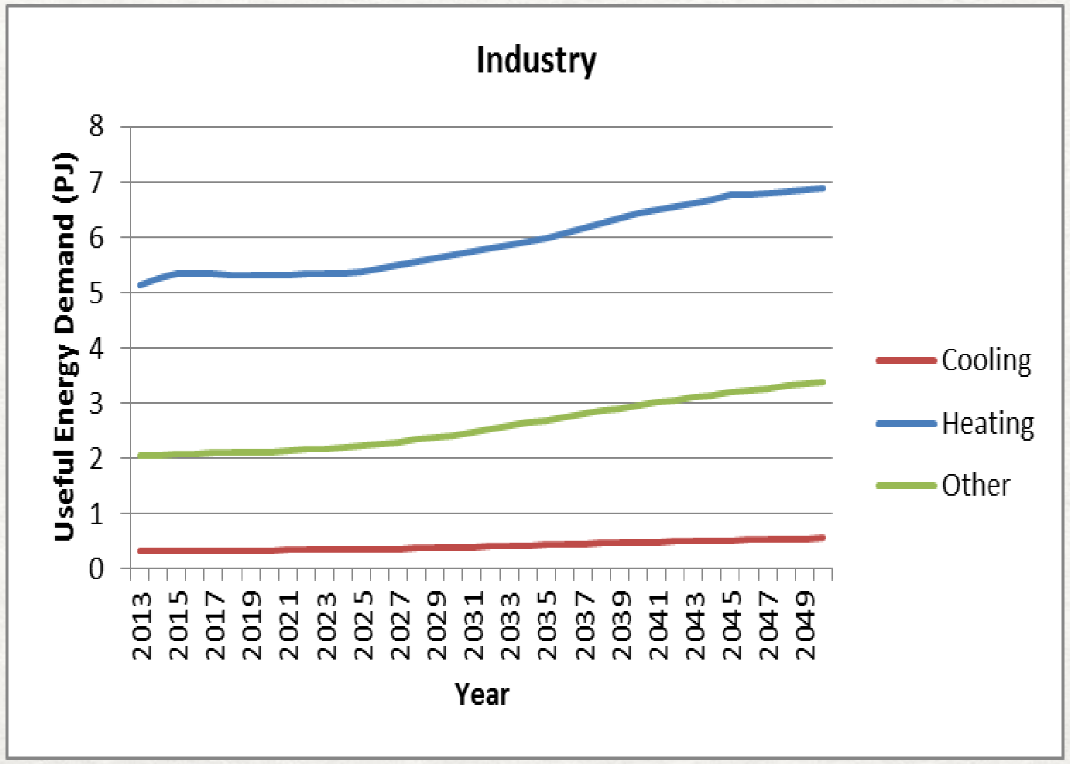




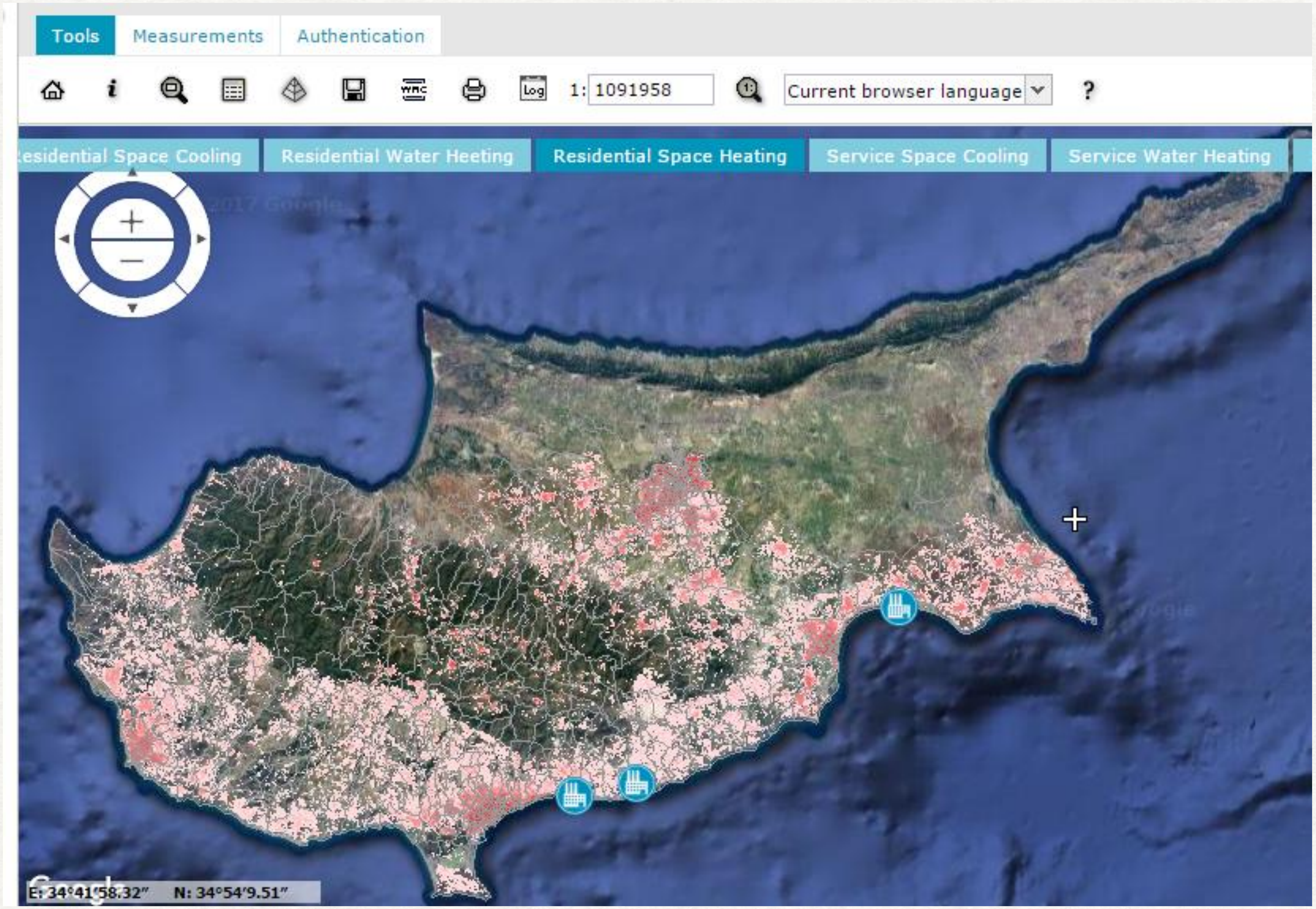
ACTIVITY 1: HEATING AND COOLING DEMAND DESCRIPTION – ENERGY DEMAND PROJECTIONS







ACTIVITY 1: HEATING AND COOLING DEMAND DESCRIPTION – HEAT MAP



The heat map consists of information regarding:

Residential Sector : Heating
Residential Sector : Cooling
Residential Sector : DHW
Tertiary Sector : Heating
Tertiary Sector : Cooling
Tertiary Sector : DHW
Industrial Sector : Heating
Industrial Sector : Cooling
Agriculture Sector : Heating

More info: http://eratosthenes.cut.ac.cy/cyheatmaps/

ACTIVITY 2: ENERGY EFFICIENCY POTENTIAL

Activity 2 is aimed identifying the technical potential, i.e the theoretical maximum amount of energy that could be produced with efficient heating and cooling solutions, disregarding all non-engineering constraints such as economic or market barriers.

Identification of technical solutions

A wide range of high efficiency heating and cooling solutions could satisfy the heating and cooling demand of different sub-sectors identified previously.

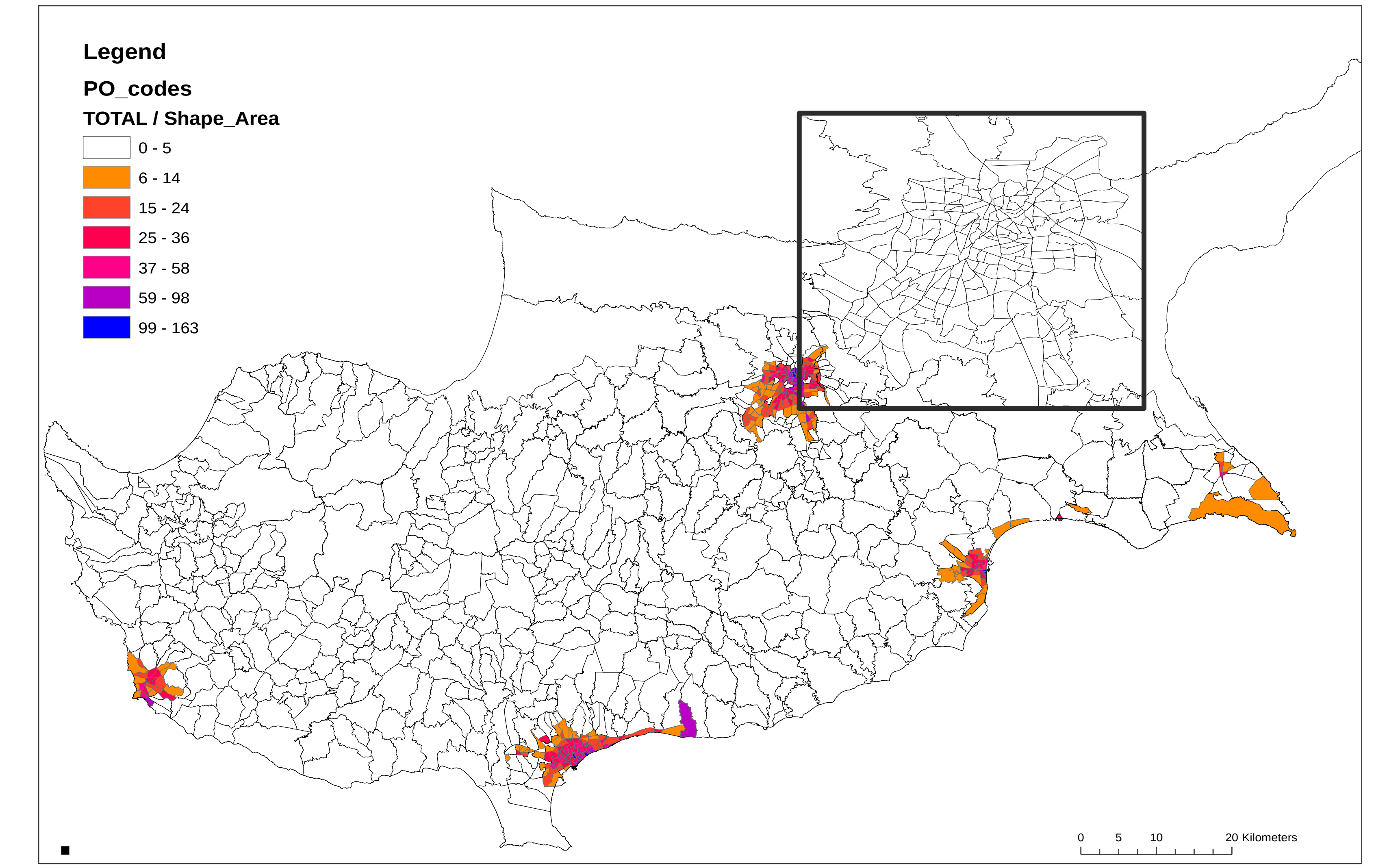
A 'solution' is a 'combination of three elements named:

- A resource;
- A technology;
- A distribution system.

SOLUTION TYPE	RESOURCE	TECHNOLOGY	PRESENT IN THE BASELINE	PRESENT IN ALTERNATIVE SCENARIO
RECOVERED RESOURCES	HEAT RECOVERY FROM POWER GENERATION			√*
RENEWABLE RESOURCES	SOLAR	SOLAR PANELS	√	√
	SOLID BIOMASS	CHP	√	√
	SOLID BIOMASS	EFFICIENT BOILERS		√
	MUNICIPAL WASTE	CHP		√
	MUNICIPAL WASTE	EFFICIENT BOILERS		√
	LIVESTOCK/INDUSTRIAL WASTE	CHP		√
	LIVESTOCK/INDUSTRIAL WASTE	EFFICIENT BOILERS		√
CONVENTIONAL RESOURCES	ELECTRICITY	HEAT PUMPS	√	√
	ELECTRICITY	SPLIT UNIT– HEAT PUMPS	√	√
	ELECTRICITY	RESISTANCE HEATERS	√	√
	GAS OIL	CHP	√	√
	LIGHT FUEL OIL	CHP		√
	LPG	CHP		√

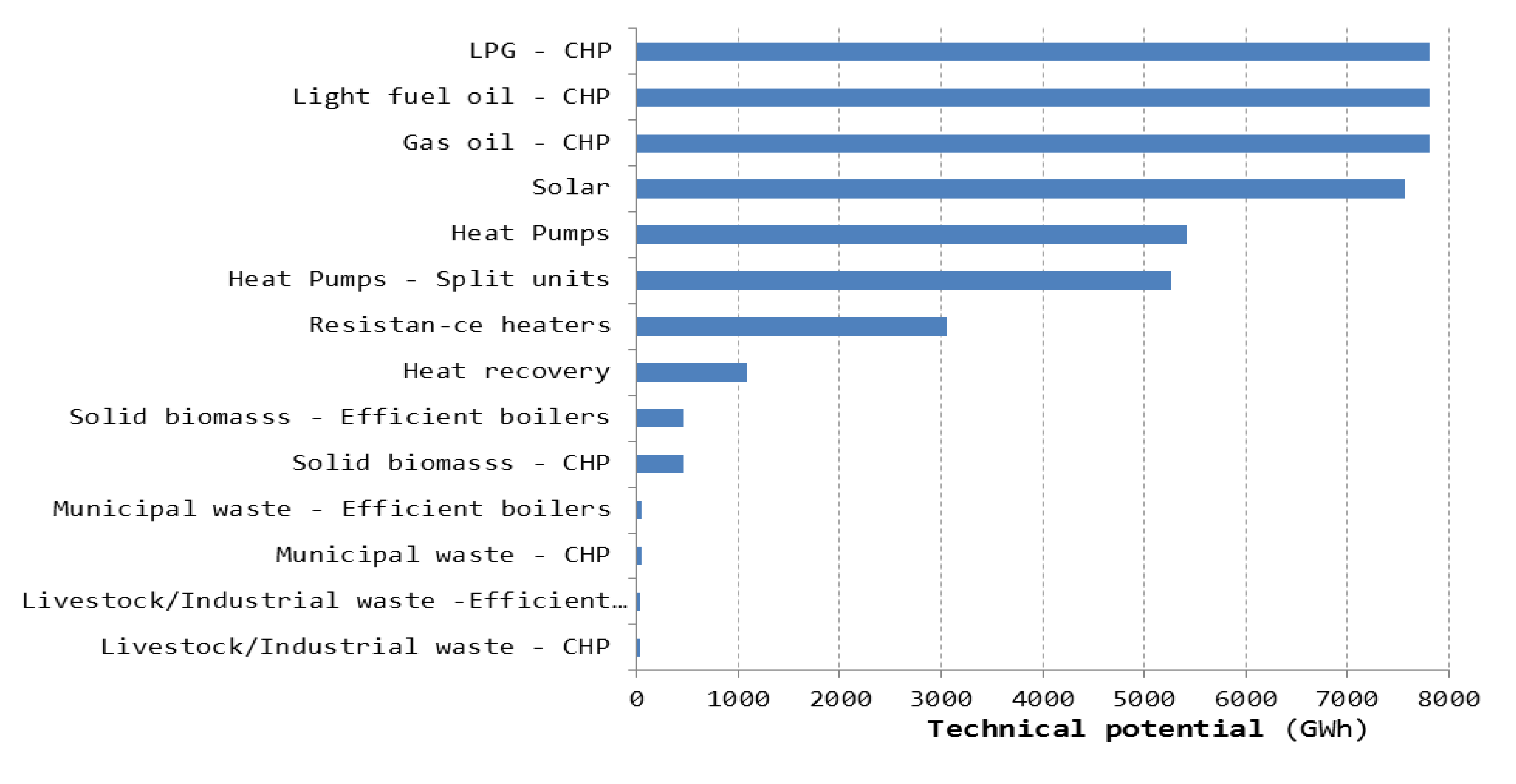
ACTIVITY 2: ENERGY EFFICIENCY POTENTIAL

In order to identify areas potentially suitable for implementation of efficient district heating and cooling solutions, the heat demand density (kWh/m² of land area) has been used as a criterion for this identification. As a minimum threshold the value of 5 kWh/m2 was used. Nearby postal codes satisfying the minimum heat demand density are grouped and forming the high demand density system.



ACTIVITY 2: ENERGY EFFICIENCY POTENTIAL

Four high demand density systems were identified, in the wider urban areas. Postal codes that do not belong to these four wider city areas are grouped in another single system boundary that encompasses the postal codes of the rest of Cyprus forming the low demand density system. In the low demand density system, only individual solutions were examined.



ACTIVITY 3: COST BENEFIT ANALYSIS

Based on the results of Activity 3 the cost-benefit analysis facilitated the identification of the most resource and cost-efficient solutions to meeting heating and cooling needs i.e the economic potential.

Construction of scenarios

The purpose of the baseline is 'to serve as a reference point, to which the alternative scenarios are evaluated'. The baseline scenario describes the most likely development of existing energy demand, supply and transformation based on current knowledge, technological development and policy measures. The baseline scenarios are prepared for all analysed sub-sectors and the demand evolution during the period 2013-2050 is taken from forecast estimations.

The alternative scenarios are built to evaluate the effects of expanding each technical solution to their maximum extent (i.e. taking into account its technical potentials). As a consequence, in each system boundary the number of alternative scenarios constructed is equal to the technically viable solutions identified during the technical potential identification exercise.

When the technical potential of a solution is lower than the demand, the rest of the demand is covered by the mix of technologies of the baseline scenario using the same shares of those technologies.

ACTIVITY 3: COST BENEFIT ANALYSIS

	Financial analysis	Economic analysis

Costs	• Capital costs (CAPEX):
	  • Renovation of existing capacity
	  • New capacity
	  • Renovation of new capacity
	• Operation and maintenance (FIXOM)
	• Fuel costs
	• CO_2 costs
		• Capital costs (CAPEX):
		  • Renovation of existing capacity
		  • New capacity
		  • Renovation of new capacity
		• Operation and maintenance (FIXOM)
		• Fuel costs (net of taxes)
		• Externalities

Benefits	• Electricity production • Residual value • Subsidies	• Electricity production • Residual value

Externalities – Energy production causes different types of environmental impacts as a consequence of the emission of pollution; land occupation and resources consumption (fuels, water, etc.) during the energy production process.

ACTIVITY 3: COST BENEFIT ANALYSIS

Each CBA was a combination of:

- One geographical system boundary
- One segment of demand (sector/subsector)
- One technical solution
- One distribution system

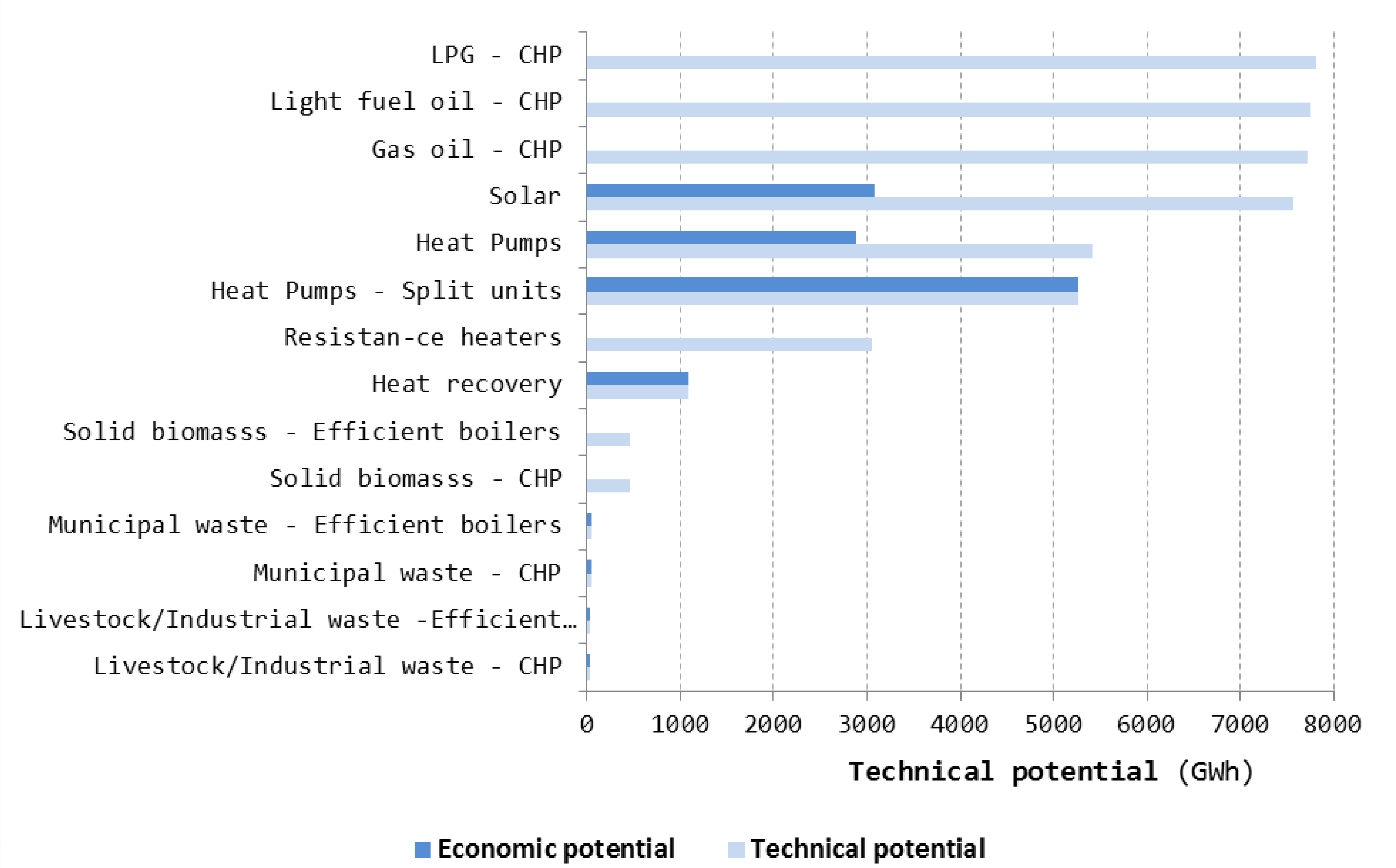
↓

2,268 CBA

ACTIVITY 3: COST BENEFIT ANALYSIS

Results of the CBA

The part of the technical potential that provides positive NPV, when compared to the baseline scenario, indicate that they are cost-effective and so constitute the economic potential of that technology.



ACTIVITY 4: PUBLIC SUPPORT MEASURES TO HEATING AND COOLING IN CYPRUS

The Comprehensive Assessment (CA) of efficient heating and cooling potentials in Cyprus show that the following heating and cooling technologies have a positive Economic Net Present Value (ENPV):

1) Heat pumps split units without water based heating system for all sub-sectors of the residential and service sectors;

2) Heat pumps with water based heating system for row and single houses as well as for healthcare, hotels and schools;

3) Heat recovery with district heating and cooling in Larnaca and Limassol;

4) Solar thermal solutions in the industrial sector and some residential row and single houses and for healthcare and schools;

5) Municipal waste use with efficient CHP and boilers for all industry sub-sectors;

6) Livestock and industrial waste use with efficient CHP and boilers for greenhouses.

The CA revealed that most technology solutions with positive ENPV (Point 1-5) have a positive FNPV too. Hence, they are commercially viable and they do not require financial support.

FOLLOW UP OF THE RESULTS OF THE CA

The Ministry of Energy is in the process of conducting the following studies, before a new policy concerning the heating and cooling sector put in place:

- ➢Determine the actual energy demand of a statistically significant percentage of different types of buildings and processes of the residential, tertiary and industrial sectors in Cyprus

- ➢ Development of a heating and cooling strategy at local level

- ➢ Development of heat network code of practice and the development of rules and policies regarding the heat network operation

Acknowledgements
The successful implementation of this study was made possible through contributions of many individuals from JRC (Johan Carlsson, Marta Santamaria ,Kostas Kavvadias, Mindaugas Jakubcionis, Ronald Piers de Raveschoot)