

Analysis of the Space Heating and Cooling Market in Europe¹

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There are major knowledge gaps concerning the European space heating and cooling market. While thorough data is available for the space heating and domestic hot water markets over the past two decades, the data regarding space cooling is still inadequate. Similarly, while the data for the residential sector is complete, the services (trade, hotels, offices, education, hospitals, and bars) sectors are virtually unexplored.

Significantly more data is available for the EU-15 group than for the EU-13 countries (member states which entered the EU more recently than 1996). Furthermore, not all of the available data is considered reliable, even though the data has been collected solely from trustworthy sources. The data from the space cooling market in the EU-13 member states is particularly questionable.

As European citizens continue to become more and more sensitive to energy utilization the demand for energy usage to be accurately estimated becomes more urgent.

Data describing the space heating, cooling and domestic hot water markets has been collected, elaborated statistically and combined using bottom-up techniques. Information regarding the space cooling market was also retrieved using a top-down approach, and the results from the two methods were compared. According to both methods, the total space cooling energy utilization is approximately 70 TWh/y. The European Commission reports a significantly lower value, of around 30 TWh/y.

Results from the bottom-up approach show a 9:1 ratio between the existing energy consumption and total potential for air-conditioning. That same ratio is approximately 1:1 for space heating. Almost 90% (about 63 out of 70 TWh/y) of the space cooling consumption occurs in the EU-15 states. Correspondingly, the potential of EU-13 member states is enormous; almost four times larger than their current energy

consumption. There is a high potential for growth in the European space cooling market, particularly in residences. Contrarily, there is almost no room for growth in the space heating market.

Space cooling is responsible for a significant part of the electricity consumption in European Union households, especially in the service sector. There has been a steady increase in the European specific and total energy consumption for space cooling during recent decades. Both the cooled floor area and the sales volume of space cooling equipment have dramatically increased since 1990.

There is a huge difference between the EU-15 and EU-13 member states space cooling consumption in residences. The EU-15 countries use approximately 30 kWh/m² y for space cooling, and the EU-13 countries utilize around 10 kWh/m² y.

The EU-15 countries use approximately 17 TWh/y while the EU-13 countries consume around 1 TWh/y in households. This is primarily because most residential buildings in the EU-13 countries do not use space cooling equipment.

Surprisingly, the EU-13 country with the most space cooling consumption in the residential sector is Cyprus, using around 0.3 TWh/y. It is also highly ranked in the EU-28, tying Portugal for fourth place despite Portugal having about ten times Cyprus' population. This occurs primarily because more than 74%, a very high percentage for European homes, of floor area in Cyprus' households is cooled. The elevated specific value for air-conditioning purposes in Cyprus contributes to that point as well.

The specific space heating consumption values for Europe have been steadily decreasing for the past two decades. The specific space heating consumption values for the EU-13 and EU-15 states are very similar, with

¹ Short summary of the PhD Thesis: Pezzutto, S., "Analysis of the Space Heating and Cooling Market in Europe", University of Natural Resources and Life Sciences, Vienna, Austria, 2014; http://permalink.obvsg.at/bok/AC10776806?&con_lng=eng

respective weighted averages of 156 kWh/m² y and 160 kWh/m² y.

Regarding European space heating, the potential energy consumption and actual space heating consumption are very similar, with a ratio of 1.2:1. Most of the energy consumption in the European Union is used for space heating, which represents 3,169 TWh/y. Within the residential sector, the EU-15 countries consume 1,544 TWh/y more space heating energy than the EU-13 countries. The EU-15 countries use approximately 1,982 TWh/y while the EU-13 countries utilize about 438 TWh/y.

There is a significant difference between the specific space heating consumption values per occupant in the EU-15 and EU-13 countries. Each occupant in the EU-15 countries uses approximately 5,457 kWh/y for space heating while the average occupant in the EU-13 countries consumes 3,787 kWh/y. This occurs primarily because of the lower economic power of people in the EU-13 countries. Across the entire European Union, the average space heating consumption per occupant is 4,681 kWh/y.

The specific domestic hot water consumption is 26 kWh/m² y for the EU-15 countries and 33 kWh/m² y in the EU-13 countries. This occurs primarily because the climates in the EU-13 countries tend to be colder than the EU-15 countries, and because the boilers in EU-15 countries are more energy efficient.

In total, the EU-15 countries consume 409 TWh/y for domestic hot water while the EU-13 countries use approximately 92 TWh/y. This represents a huge difference of 317 TWh/y.

A comparison between the potential and actual domestic hot water consumption values shows that there is limited room for growth in the domestic hot water market. The ratio is approximately 1:1, with each value around 501 TWh/y.

Similarly to the space heating occupant behaviour data, the domestic hot water occupant behaviour data shows that people in the EU-15 countries use more energy than the people in the EU-13 countries. EU-15 occupants and EU-13 occupants use 1,079 kWh/inhabitant y and 942 kWh/inhabitant y respectively.

The energy use patterns of Poland are interestingly similar to those of Germany. The two countries return the highest energy consumption values for the majority of cases, usually representing around 1/3 of each type of energy consumption (space heating, cooling and domestic hot water). The economic strength of a country has a significant impact on their energy consumption, and the Polish and German economies are both the strongest within their group of European Union countries (EU-13 and EU-15 respectively).

Comparisons between the total (combining the service and residential sectors) energy consumption of space heating, cooling and domestic hot water within the European Union show that space heating consumes the most energy, with domestic hot water consumption the second most and space cooling the least. Space heating consumes around 3,169 TWh/y, domestic hot water consumes approximately 501 TWh/y and space cooling consumes about 68 TWh/y. Thus space heating uses around six times as much energy as domestic hot water and about 46 times as much energy as space cooling.

A Porter's five forces analysis indicates that the space cooling market has been fairly steadily rising for about two decades, and that it is currently in a healthy state. In contrast, a number of reports concerning the same topic show the treated sector to be a booming market. Taking into consideration that in the majority of cases air-conditioning is not a commodity of primary necessity and that the space cooling market is suffering significantly due to the economic crisis, this result appears to be trustful.

The main driver behind the investigated market is research and development: however, the sector secures only a small part (7%) of the total European Union funding for heating and cooling research. Funding for heating and cooling research, when expressed as a percentage, decreased between the Sixth and Seventh Framework Programmes. In the Sixth Framework Programme it received 8% of the funding, while it got only 7% in the seventh.

A fundamental and technical analysis indicates that the European Union financial support for the heating and cooling sector, as a percent of total research funding, will decrease until 2020: to 6%. The latter indicated time frame equals to the end of the recently begun follow up of the Seventh Framework Programme: Horizon 2020. However, the latter finance has been indicated to rise in terms of absolute amount of money.

A Multiple-criteria decision analysis shows once more a slightly positive evolvment of the space cooling market and that it will be especially sensitive to:

- i) Research and development;
- ii) The economic crisis and
- iii) Higher comfort standards requested by the European population.

The space cooling market forecasts, provided by the aforementioned Porter five forces and Multiple-criteria decision analysis, show both a high dependence on research and development activities and a moderate increase of the European air-conditioning market until 2020. The two carried out economic models – a quantitative and a qualitative one – indicate practically the same result.

The outcomes from the performed investigations show that the space heating market is almost fully saturated, as it is a commodity of primary necessity. In contrast, the space cooling market in Europe is expected to gradually increase in future. The main factors influencing this tendency lie in the fact that:

- i) Space cooling is only an asset of primary necessity for specific building types and climates;
- ii) The customers' purchasing power reduction and
- iii) The growth of electricity prices.