Analysis of the electricity demand of Greece for optimal planning of a large-scale hybrid renewable energy system

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1. Abstract

The Greek electricity system is examined for the period 2002-2014. The demand load data are analyzed at various time scales (hourly, daily, seasonal and annual) and they are related to the mean daily temperature and the gross domestic product (GDP) of Greece for the same time period. The prediction of energy demand, a product of the Greek Independent Power Transmission Operator, is also compared with the demand load. Interesting results about the change of the electricity demand scheme after the year 2010 are derived. This change is related to the decrease of the GDP during the period 2010-2014. The results of the analysis will be used in the development of an energy forecasting system which will be a part of a framework for optimal planning of a large-scale hybrid renewable energy system in which hydropower plays the dominant role.

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2. Background

Some studies on the electricity demand of Greece and Cyprus follow:

• Psilis et al. (2009) present an analysis of the electricity demand in Athens, the capital city of Greece, for the time period 1997–2001. The electricity demand in Athens is about 50% of the total electricity demand in Greece.
• Tsani (2010) investigates the relationship between the energy consumption and economic growth in Greece for the time period 1960–2006.
• Andreades et al., (2011) provide an overview of the Greek wholesale electricity market.
• Koroneos et al., (2011) analyze the energy and energy utilization in the energy sector of Greece for the time period 1990–2004.
• Marques et al., (2014) analyzed the interactions between electricity generation sources and industrial production in Greece for the time period 2004–2013.

3. Demand load and load prediction data

4. Daily and weekly behaviour of the demand load

5. Monthly behaviour of the demand load

6. Extreme values and the New Year’s Eve

7. Demand load, temperature and GDP

8. Demand load and temperature

9. Demand load and temperature

10. Demand load and load prediction

11. Conclusions

References


For smaller or bigger temperatures, we observe an increase of the demand load not coinciding with temperatures corresponding to winter months and bigger temperatures correspond to summer months.

A global minimum for the demand load is observed for temperatures around 17-18 °C.

The temperature measured at the Meteorological Station of Athens Airport is related to the demand load.
• Demand load is in Athens, which is inhabited by 15% of the population of Greece.
• It is fair to say that it is less sensitive to temperature variations.

The Independent Power Transmission Operator is used in the analysis.

• Moves every month by 35% of the population of Greece.
• It is near the sea, thus it is less sensitive to temperature variations.

Local minima

• Change of behaviour

After the hydrological year 2011 the monthly demand load in December was increased considerably.

Local maxima

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