

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 analysed 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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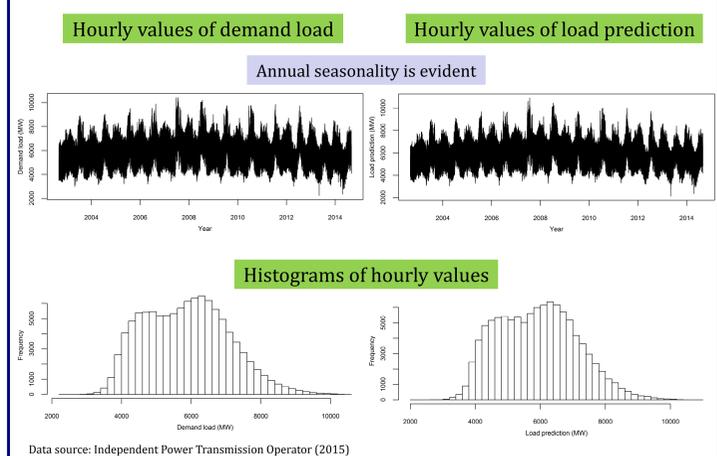
2. Background

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

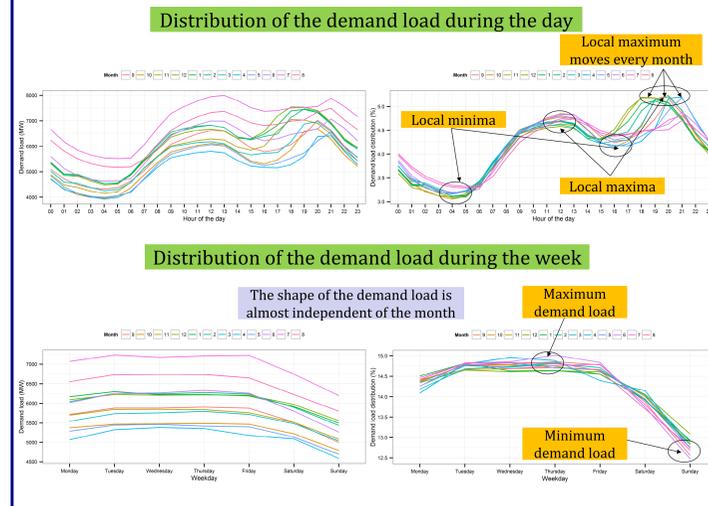
- Psiloglou et al. (2009) present an analysis of the electricity demand in Athens, the capital city of Greece, for the time period 1997-2001. The electricity demand in Athens is about the 50% of the total electricity demand in Greece.
- Tsani (2010) investigates the relationship between the energy consumption and economic growth in Greece for the time period 1960-2006.
- Andrianesis et al. (2011) provide an overview of the Greek wholesale electricity market.
- Koroneos et al. (2011) analyse the energy and exergy utilization in the energy sector of Greece for the time period 1990-2004.
- Marques et al. (2014) analysed the interactions between electricity generation sources and industrial production in Greece for the time period 2004-2013.
- Zachariadis and Pashourtidou (2007) present an empirical analysis of electricity consumption in Cyprus for the time period 1960-2004.

In this presentation we analyse the electricity demand in Greece for the time period 2002-2014.

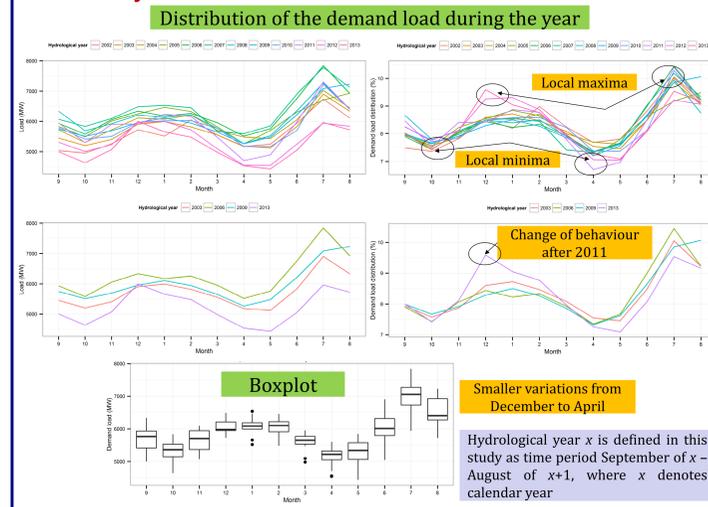
3. Demand load and load prediction data



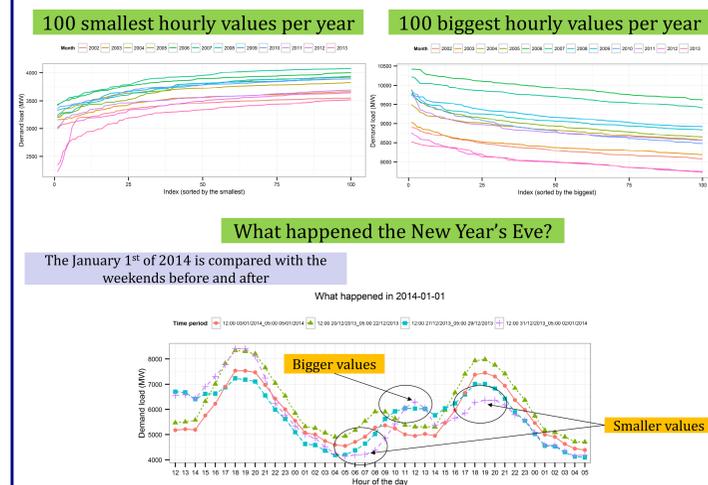
4. Daily and weekly behaviour of the demand load



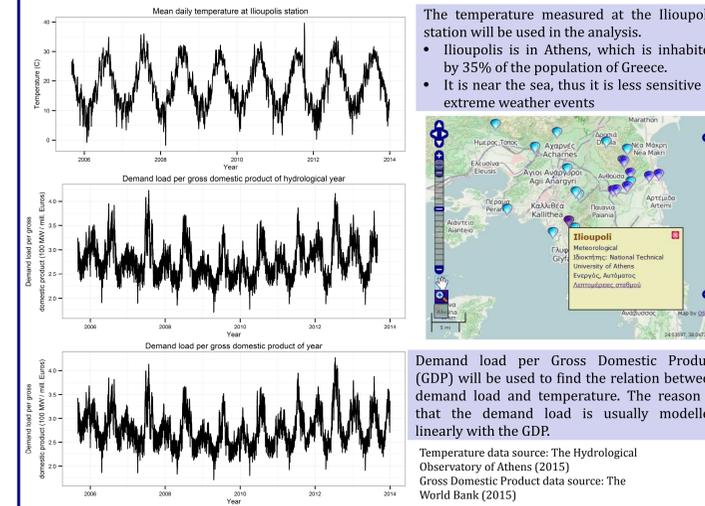
5. Monthly behaviour of the demand load



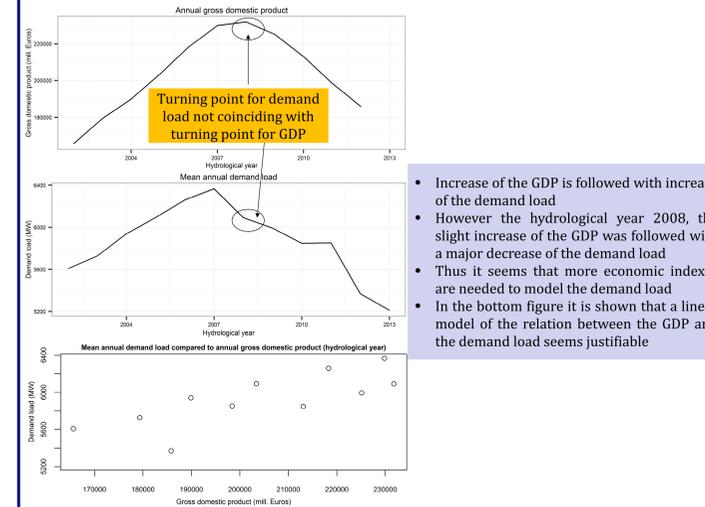
6. Extreme values and the New Year's Eve



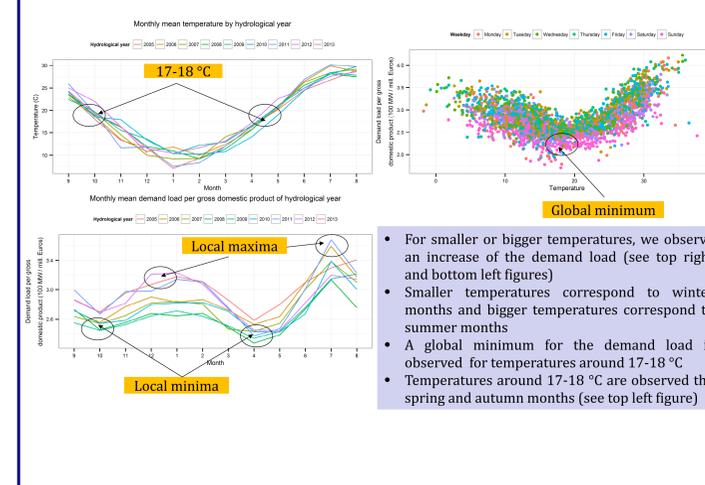
7. Demand load, temperature and GDP



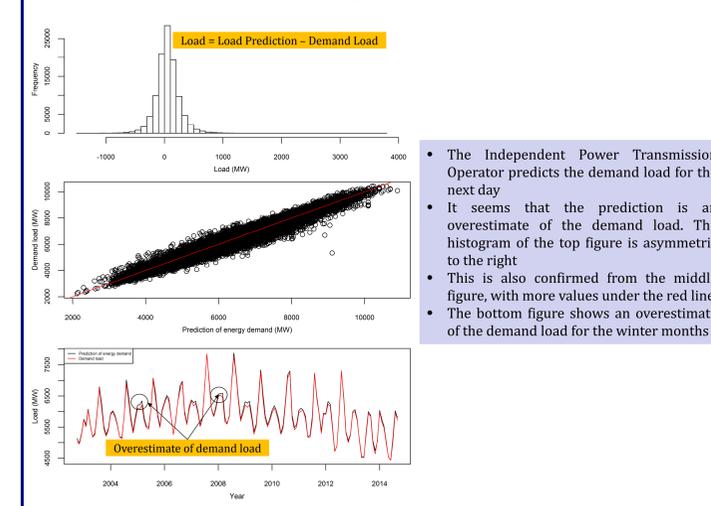
8. Demand load and GDP



9. Demand load and temperature



10. Demand load and load prediction



11. Conclusions

- Global hourly maximum during the day around 20:00 and another local maximum around 12:00. Local minima around 04:00 and 16:00.
- Maxima of the daily demand load are observed on Wednesdays or Thursdays and minimum of the demand load is observed on Sundays.
- The shape of the daily demand load is almost independent of the month.
- Local maxima of the monthly demand load are observed in January and July and local minima of the demand load are observed in October and April.
- After the hydrological year 2011 the monthly demand load in December was increased considerably.
- Smaller variations of the monthly demand load are observed from December to April.
- A linear model of the relation between the GDP and the demand load seems justifiable. Furthermore an increase of the GDP usually results in an increase of the demand load (or vice versa?).
- However the hydrological year 2008 the increase of the GDP was not followed by an increase of the demand load.
- A global minimum for the hourly demand loads is observed for temperatures around 17-18 °C.
- Local maxima of the demand load are observed for the temperatures around 3 °C and around 32 °C.
- A regression line for the demand load (in the y axis) and the temperature (in the x axis) would be convex.
- The Independent Power Transmission Operator's daily predictions usually overestimate the demand load.

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