THE VALUE OF ENERGY SUPPLY SECURITY: THE COSTS OF POWER OUTAGES TO HOUSEHOLDS, FIRMS AND THE PUBLIC SECTOR

Johannes REICHL; [1]Michael SCHMIDTHALER*[2], Friedrich SCHNEIDER[3]

Introduction

This paper presents a model for assessing economic losses caused by electricity cuts and the willingness to pay to avoid these outages as an approximation of the value of energy supply security (ESS). Economic losses occurring as a result of prolonged outages are calculated for simulated power cuts lasting from 1 to 48 hours, taking the respective season, day of the week and time of day into consideration. The simulated power cuts can be defined for the nine Austrian provinces and the costs due to power cuts are computed separately for all sectors of the economy and for households.

Methodology

The expected damages from a large scale supply interruption are being evaluated using both a macroeconomic direct worth assessment for businesses, institutions and public entities and a Contingent-Valuation-based Willingness-to-Pay analysis for households. This methodology provides an assessment tool for a power outage using pre-defined characteristics. The effect of prior warning has been evaluated. In some cases, consumers have no opportunity to anticipate and thus prepare for the outage. Furthermore the project results were implemented in an economic tool for assessing simulated power cuts. This tool (APOSTEL) can be downloaded from the website of the Energy Institute at the Johannes Kepler University Linz (www.energieinstitut-linz.at). The tool was implemented as Excel-based VBA software and enables policy makers and interested stakeholders to assess the monetary value of Energy Supply Security based on exemplary power cut scenarios.

Our estimation is based on two surveys, in which 1.307 households and about 300 institutions were extensively interviewed about their vulnerability to power outages. Due to a distortive nature of certain quantification methods (such as the “Value of Lost Load”, or VoLL), we suggest a unique reference technique for Non-Households called the “Value of Lost Load per hour and employee” (in €/kWh). This reduces the VoLL’s distortive bias, which assigns large electricity consumers low (relative) damages, thereby sending a suboptimal signal of the importance of a secure energy supply to policy makers.

Results

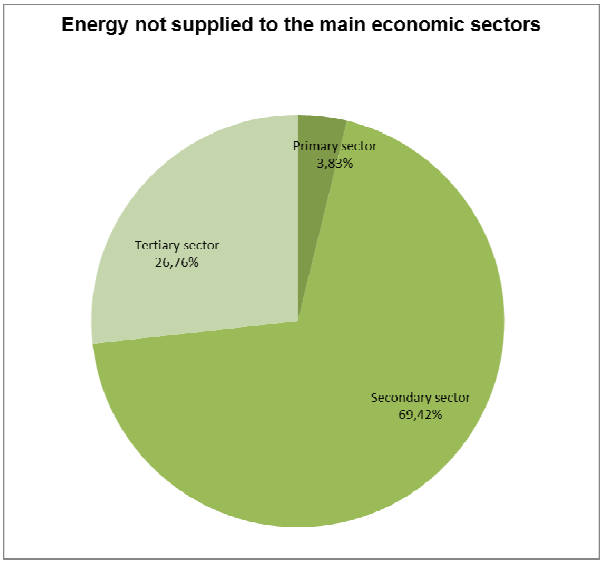
Our model suggests that the Austrian society is highly vulnerable to large scale power outages and that, for incidence, a 48-hour outage of the whole of Austria would imply outage costs of about 1.68 billion €. We found a non-linear relationship between time and costs. The Austrian energy system is among to the most reliable in the world. The quantification of the value of Energy Supply Security however is urgently needed in order to enable benefit-cost analyses of future infrastructure investments. We calculated the “Value of Lost Load” (VoLL) for every business sector in the statistic nomenclature ÖNACE2008 with an unprecedented accuracy at state-level. The quantified VoLL-figures support the notion that the value of supply security by far exceeds the current price of electricity and that Energy Supply Security is a basic necessity (e.g. Leontief production input), which is currently not being considered adequately in the political agenda.

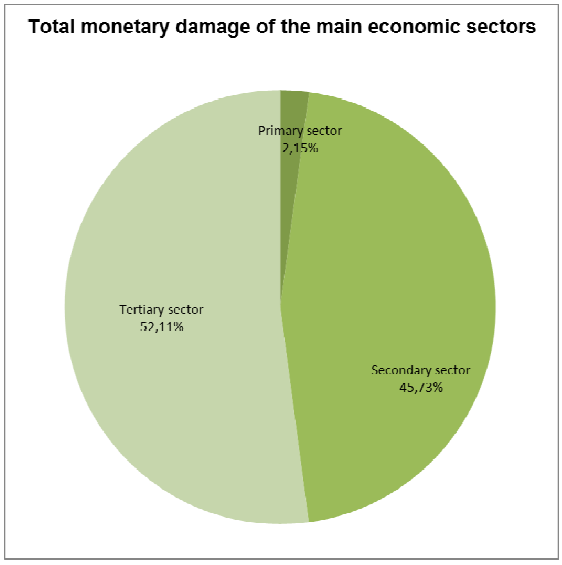
[1] Energy Institute at the Johannes Kepler Universität Linz, Altenberger Straße 69, A-4040 Linz; e–mail: reichl@energieinstitut-linz.at, schmidthaler@energieinstitut-linz.at,
[2] Energy Institute at the Johannes Kepler Universität Linz, Altenberger Straße 69, A-4040 Linz; e–mail: reichl@energieinstitut-linz.at, schmidthaler@energieinstitut-linz.at, 0732 2468 5665
[3] Institute of Economics, Johannes Kepler Universität Linz, Altenberger Straße 69, A-4040 Linz; e–mail: friedrich.schneider@jku.at

One application of the outage simulation tool APOSTEL is depicted below. As an example, we evaluated a power outage in Styria on February 15, 2012, starting at 8 a.m and lasting until the following day 8 a.m. This exemplary outage scenario has no historic legitimacy as the reliability standards in Austria are much better (SAIDI on average below than one hour per year), but it illustrates the importance of a secure energy supply for the Styrian economy and its people.

Power Outage in Styria on a workday lasting 24 hours	
Date of outage begin	15.02.2012
Starting time of power supply interruption	8:00
Duration of power supply interruption (in hours)	24
Regional scale of the power outage (state level)	Styria
Date check	The day the power outage occurs is a workday.

The following graphs depict the distribution of the energy not supplied and the total monetary damages to each of the three primary economic sectors which occur in the case of the analysed outage given the properties stated above. The secondary sector experiences the highest share of unsupplied electricity, but due to the higher share of services in the GDP, the tertiary sector is bound to face the highest of monetary damages. This distribution varies significantly in other states depending on the structure of the economy (share of services of the value added).





We conclude that the issue of energy supply security is not represented appropriately in the discussion of the design of the energy system of the future, which will be characterized by a large scale implementation of renewable energy sources, intelligent grids and metering devices and efforts to enhance the efficacy of the entire system (e.g. by means of demand response or load shifts). Summarizing we conclude for the analysed power interruption with the stated properties that:

- the economic loss to the Styrian businesses and public administration amounts to 86.6 Mio €,
- the VoLL is calculated to be 3.5 €/kWh, the damage per employee and hour is 6.5 €,
- households are willing to pay 10.8 Mio€ to avoid this outage, which is equivalent to 1.5 €/kWh,
- 270,497 households and 36,144 businesses are negatively affected by this outage scenario.