LONG-TERM FORECAST OF RESIDENTIAL & COMMERCIAL GAS DEMAND IN GERMANY

Mostafa Fallahnejad[a,*], Benedikt Eberl[b], Maik Günther[c]

[a]E370 - Institute of energy systems and electrical drives
[b]Forschungsstelle für Energiewirtschaft mbH, Munich, Germany
[c]Stadtwerke München, Munich, Germany

ABSTRACT

Natural gas demand of non-daily metered customers (residen-tial and commercial sectors) in Germany can be calculated using Standard Load Profiles (SLPs) and temperature forecasts. SLPs were generated with historic data and represent the actual situation. But they are not helpful for the calculation of daily gas demand in long-term. Better insulation of buildings and more efficient heating systems will change the SLPs in the future. Thus, in this paper a LP model was developed to create SLPs for the future. The model is executed for one- and two-family dwellings, apartments and the commercial sector for the years 2016, 2025 and 2040. The obtained SLPs demonstrate that year by year, the heating phase will be started at colder temperatures. Moreover, the new SLPs are used to calculate the daily gas demand. The demand profiles reveal that in future, the reduction of the gas demand in colder months is higher than in warmer months.

Keywords*: Standard Load Profile; Natural Gas Demand; Residential Sector; Commercial Sector; LP*

INTRODUCTION

Standard Load Profiles (SLPs) are used to forecast the daily consumption of natural gas by small customers. In general, there are two categories of natural gas consumers: non-daily metered consumers (or SLP customers) and real-time metered customers (or RLM customers). SLP customer is referred to a customer with an annual consumption of less than 1,500 MWh and an installed power of less than 500 kW per hour.

The gas utility companies were in the past involved in the determination of gas consumption of non-daily metered customers. In 2000, these measurements were centrally recorded and organized by the Federal Association of German Gas and Water Industries (in German: Bundesverband der deutschen Gas- und Wasserwirtschaft; BGW) and the Association of Local Utility Companies (in German: Verband Kommunaler Unternehmen; VKU). In addition, further measurements were supplemented with respect to the customer groups and temperature ranges in order to obtain sufficient data for statistical analyses [1]. Based on these measurements, the Department for Energy and Application Technology at Technical University of Munich (TUM) was commissioned by BGW and VKU to derive tem-perature-dependent load profiles for the gas supply [2]. In 2002, eight different load profiles for the residential customers and fourteen different load profiles for the commercial sector were developed [3], [4]. Based on the experiences gained, the primary SLPs were modified in 2005. In these regards, within the residential sector a profile for the one- and two-family dwellings and a profile for the apartments were introduced. With-in the commercial sector, on the other hand, the number of profiles was reduced to eleven. Additionally, one general profile representing the whole commercial sec-tor was presented [5].

The SLPs generated at TUM established a standard in this field. The primary SLPs have been continuously revised and updated in order to match to the current situations and provide a better

forecast. A summary of the revisions made to the SLPs can be found in [2]. The synthetic SLPs were used by more than 83% of the operators in 2014. According to the Federal Network Agency (in German: Bundesnetzagentur; BNetzA), nearly all exit point operators (98%) used SLPs when delivering to household or small business customers [6]. In June 2015, the most recent revision of SLPs was published by Federal Association of Energy and Water (in German: Bundesverband der Energie- und Wasser-wirtschaft e.V.; BDEW) in cooperation with VKU and the European Association of Business and Distribution Organizations for Energy (GEODE). From 1st October 2015, all network operators can use the new profiles [7]. In the recent revision, the so called SigLinDE profiles were introduced. These profiles are composed of a sigmoid term and a linear term. The aim for adding the linear term was to adjust the profiles for the cold tem-peratures and review the profiles at the high tempera-tures.

Stadtwerke München GmbH (SWM) operates the worldwide gas market model WEGA to analyze gas prices and trade flows till 2040 [8]. An input parameter for the model is the daily gas demand from 2016 to 2040. Actual SLPs are based on historic data and they are not helpful to calculate the daily demand of SLP customers in long-term. It is expected that in the future buildings better thermal insulations and more efficient heating systems are employed, and also the family structures and the floor space per person will change. No research could be identified in which creation of SLPs for the future is discussed. Thus, new SLPs are created in this paper for one- and two-family dwellings (EFH), apartments (MFH) and the commercial sector (GHD) for the years 2016, 2025 and 2040. For this purpose, the linearization concept SigLinDE is used in a LP model in GAMS environment. Based on these new SLPs for the future the daily demand for 2016, 2025 and 2040 is calculated.

REFERENCES

[1] BGW, and VKU, “Praxisinformation P 2006/8 Gastransport/Betriebswirtschaft. Abwicklung von Standardlastprofilen zur Belieferung nicht-leistungsgemessener Kunden”, 2006.

[2] S. von Roon, T. Gobmaier, K. Wachinger, and M. Hinterstocker, „Statusbericht zum Standardlastprofilverfahren Gas“, 2014.

[3] B. Geiger, and M. Hellwig, „Entwicklung von Lastprofilen für die Gaswirtschaft - Gewerbe, Handel und Dienstleistung“, 2002.

[4] M. Hellwig, „Entwicklung und Anwendung parametrisierter Standard-Lastprofile“, PhD thesis, TU Munich, 2003.

[6] BNetzA, „Monitoring report 2015“, 2016.

[5] U. Wagner, and B. Geiger, „Gutachten zur Festlegung von Standardlastprofilen Haushalte und Gewerbe für BGW und VKU“, 2005.

[7] BDEW, VKU, and GEODE, “Abwicklung von Standardlastprofilen Gas”, 2015.

[8] M. Günther, “Practical Application of a Worldwide Gasmarket Model at Stadtwerke München”, in Operations Research Proceedings 2015, in press, 2016.