Stranded Generation Assets and the Future Implications for the European Gas Network

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Ambitious European targets for renewable energy call for a vast mobilization of capital. At the same time, European electricity market reform, reduced electricity demand, and decarbonisation of electricity generation have had unexpected consequences for risk and return for power sector investors with investments in thermal generation assets (primarily gas-fired generation) becoming stranded and mothballed (Caldecott & McDaniels 2014). Over the last decade, European utilities have been the worst performing sector in the Morgan Stanley index of share prices, halving the market capitalization of some European electric power utilities throughout this period (Caldecott et al. 2017). The drop in market valuation of these assets in recent years reflects investor uncertainty and stranded asset risk for these assets has begun to receive significant attention from investors, rating agencies and regulators. The share of electricity demand from variable renewable power generation is limited by the non-synchronous nature of wind and solar PV (Ibrahim et al. 2011). Sources of flexibility, such as gas-fired generation assets, are required to increase these limits and support a further penetration of variable renewables (Lannoye et al. 2012). Achieving generation adequacy has become a challenge for the EU internal electricity market through the energy-only market model operating in some member states (EPRS 2017). A number of member states have introduced capacity mechanisms which compensate generators for the availability of existing and support an investment case for future generation capacity to supply electricity (Huhta 2018). For example, in 2018, the European Commission approved six additional forms of capacity mechanisms concerned with more than half of the EU population in Germany, Belgium, Italy, Poland, France and Greece (European Commission, 2018).

This paper evaluates the investment risk for both gas fired generation and gas network assets in each of the EU member states using an emissions reduction scenario for 2030. A detailed model-based analysis is developed under the assumptions of the European Commission Reference Scenario 2016. This is coupled with a power system simulation and investment appraisal model to assess if returns to owners of gas generation assets in each EU member state are sufficient to incentivise investment in new gas generation assets in an 'energy only' market. The outputs from this analysis are then linked with a high-level gas network investment and tariff allocation model to assess the implications of significant reductions in gas demand from the power generation sector for owners of gas transmission assets.

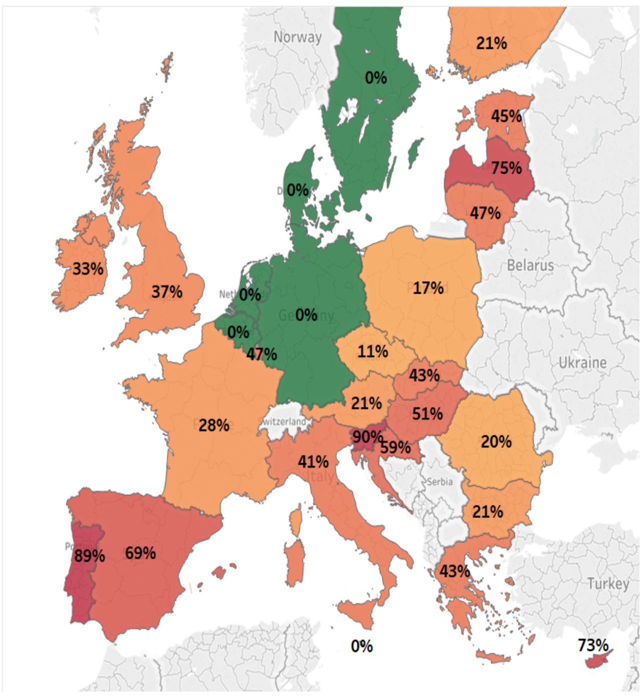
Simulating Future Market Conditions

Visions for the future, through energy systems modelling, offer useful insights into how market conditions may evolve. In 2016, the European Commission published the "EU Reference Scenario 2016, Energy, Transport and GHG Emissions, Trends to 2050" hereafter EC Ref. (European Commission 2016). The scenario provides a benchmark for current policy and market trends. It starts from the assumption that the legally binding GHG and RES targets for 2020 will be achieved and that the policies agreed at EU and Member State level until December 2014 will be implemented. The market pricing and operational assumptions for gas generation assets and the gas network are derived from a soft-linking approach between an energy system scenario (the EC ref.) and power system model, as described by (Deane et al. 2012). A Discounted Cash Flow (DCF) model is used to value generation assets and a tariff allocation model for the gas network. The assumption of the DCF model is that generators must achieve a minimum Internal Rate of Return (IRR) of 8% (the hurdle rate of return for capital to be forthcoming from investors) to incentivise investment in these assets, this is generally the purpose of capacity remuneration mechanisms (Pototschnig & Godfried 2014). Payments outside of the energy only market to achieve this are known as out of market payments in this analysis. The required revenue of each member states gas network to remain viable is calculated and tariffs are allocated to all network users based on their respective demand for gas and the operational cost of the member states network. Cost assumptions for power generation assets and the network are sourced from a variety of industrial sources and surveys (JRC 2014; ACER 2015; Lochner 2011). The cost of debt is calculated using a combination of the member state specific 20 year bond yields and a European utility corporate debt premium.

The Future for Gas Generation Assets

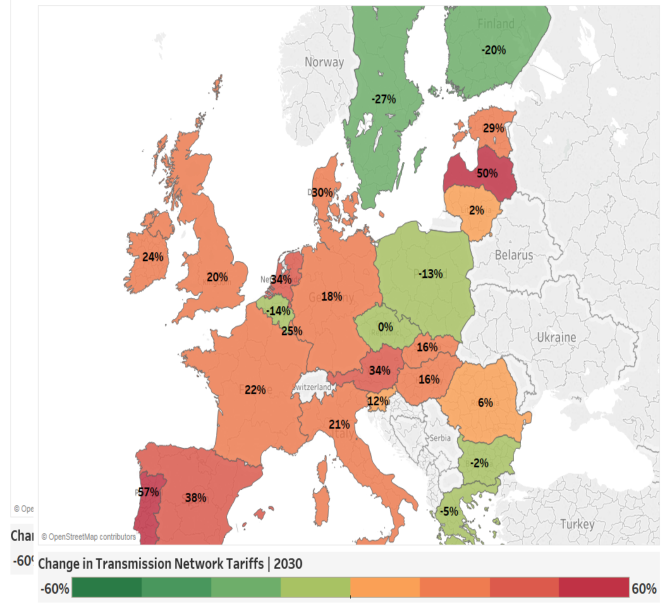
Figure 1 shows the percentage of total generator revenues from out of market payments required to achieve and IRR of 8% for owners of gas generation assets. Countries which achieve this return in an 'energy only' market are shown

Proportion of Generator Revenue from Out of Market Payments



Change in Transmission Network Tariffs | 2030

Change in Transmission Network Tariffs | 2030



on the graph as 0%. However, the majority of counties will require either capacity payments or other out of market payments to incentivise investment. Member states heavily reliant on out of market payments see gas generation assets out of merit and not recovering long run marginal costs. In an 'energy only' market, investment is unlikely to be forthcoming as investors will not receive adequate return.

The Future for Gas Networks

In the second part of our analysis, we examine the implications of reduced running hours for gas generators on the flow of gas through the gas network and hence payments and return on investment to owners of gas network assets. Figure 2 illustrates a potential change in tariffs charged to gas transmission network customers for transporting gas which factors in gas demand for power generation but also other sectors. These changes in tariffs are required to recover network costs which are largely fixed.

Networks with a greater proportion of gas used in power generation relative to final energy demand are subject to a greater risk of tariff increases in this period. Portugal which could see the highest increase in tariffs is largely being driven from a decline in gas consumption in sectors outside of power generation such as residential, services and industrial demand for gas. The same is also true for Spain and Latvia. This shows that the demand for gas in other sectors can have an impact on the viability of gas in power generation. Interestingly, in some member states, while a fall in gas demand in power generation is increasing tariffs an increase in gas consumption in other sectors is reducing them.

Conclusion

Decarbonisation of European electricity generation has led to significant price volatility and changes in operational regimes for owners of gas generation assets. This has significant implications for risk and return for investors in European electricity generation and related infrastructure assets. This paper provides the first Europe wide assessment of the comparative risk for investors in gas generation and network transmission assets. The findings of this analysis point to an uncertain future for both gas generation and network assets in Europe. Under the assumptions of the European Commission Reference Scenario the investment case depends on the availability of out of market payments. Without significant market reform, investment capital is unlikely to be forthcoming.

Capacity remuneration payments and other out of market payments are being used in member some member states to ensure that gas generation assets recover long run marginal costs (their capital costs) . and to reward generators who provide system services to balance variability from renewables. This analysis represents just one vision for the future, with an assumed price of gas, and there are limitations to the financial modelling approach. However, the paper highlights issues for regulators and policy makers if the EU Target Electricity Model's objectives of reliability, sustainability and affordability are to be maintained.

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Dual Plenary Session 2: Understanding Individual and Collective Consumer Behavior

Summarized by Gloria JinaKim, PhD student, KAIST, Korea

This Dual Plenary Session was chaired by Reinhard Madlener, RWTH Aachen, Germany. He was joined on the panel by Anna Alberini, Dept. of Agricultural and Resource Economics, University of Maryland, USA, Marilyn Brown, School of Public Policy, Georgia Tech, USA, and Kristina Rodig, Head of Global Customer and Market Insights, E.ON, Essen, Germany.

The three speakers discussed the needs and behavior of energy consumers / prosumers, both at the individual level and the aggregate level.

Anna opened the discussion about consumers' understanding on energy price and energy efficiency. She suggested possible behavioral theories, such as habit formation and salience bias that possibly explain consumers' price insensitivity.

Marilyn continued her discussion about the cost of information. Focusing on energy efficiency gap, she proposed plethora of social theories, like beliefs, attitudes, values, social norm and other contextual factors. She enlightened the need for reconciliation of the array of concepts, frameworks and theoretical platforms.

Kristina enriched the panel discussion by adding the real-world practice of consumer behavior. She presented several segments of consumers and appealed the needs for consumer centric lifetime approach for understanding consumer behaviors.