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DSM situation in Finland in 2014

There has been recent significant development regarding demand response (DR) so this situation review focuses on it. In 2014 the development regarding energy efficiency (EE) situation and the integration of DR and EE has been slower. Especially improving the integration may become the big DSM issue in the coming years.

Demand Response

In the Finnish electricity system and electricity market price area demand response is very important. Much of the generation is based on base load nuclear (2.75 GW in 2013) and thermal load driven CHP (7.3 GW in 2013). There is only about 3 GW on hydro power and about 3.2 GW on condensing power. The penetration of intermittent generation from renewable energy sources was about 250 MW in 2013 but is rather rapidly increasing. More accurate figures for each year are available from the Finnish Energy Market Authority. Even 15-20% of the electricity is imported and during 1/1/2014 - 10/5/2014 Finland was a separate price area nearly 50% of the time. Thus on the supply side there is rather limited flexibility and this flexibility is concentrated to too few actors. Without demand response such a system would run an unacceptably high risk of high price peaks, market failures and resulting blackouts.

The Nordic whole sale market Nordpool www.nordpoolspot.com allows demand side participation and has products that can be used for the purpose. There are some needs and initiatives to develop products in order to even better cover the properties of demand side flexibilities. Entry fees and minimum sizes of transactions limit out the direct participation of small actors. In Finland the electricity retail market also supports demand response even for the small customers, because practically all customers are settled based on their hourly measured consumption. Thus it is easy to use dynamic pricing and verify and the responses and take them into account in the settlement.

The price variations in the Nordpool have recently been reasonably modest and thus participation in the reserves markets has been more profitable for those resources that meet the tighter requirements. This situation is expected to vary with the expected changes in the electricity market and system. Also balancing market accepts and draws some demand side flexibility. The reserves markets and the balancing market are operated by the system operator Fingrid (www.fingrid.fi) and accept demand side resources that are aggregated to meet the minimum requirements for response regarding size etc. Depending on the type of the reserves market the minimum size varies from 0.1 MW to 10 MW and maximum response latency from seconds to 15 minutes. According to the system operator Fingrid the amount of dynamic demand response in Finland in 2014 comprised the following: day ahead market Elspot 200 - 600 MW (estimate), balancing power market 100 - 300 MW (estimate), frequency controlled disturbance reserve 70 MW, fast disturbance reserve 385 MW and power reserve 40 MW. In addition to that there is over 1 GW of static time of use control. In 2014 Fingrid has three pilots, each with a different aggregator. The aggregators are SEAM, Energiakolmio and There Corporation.

Large energy intensive industries already participate in demand response. Questionnaires in 2005 indicated that short time (lasting 1 to 3 hours) Demand Response without an advance warning amounts to

about 1060 MW, which is 7.5 % of the one-hour peak average power (14 040 MW) experienced up to 2005. 755 MW of the demand response potential of large industry is already reserved for the system operator, to be used as disturbance reserves etc., when the new nuclear unit starts. This comprises 385 MW fast disturbance reserves, 70 MW frequency controlled disturbance reserves and 300 MW nuclear power plant specific system reserve. When the advance warning time for carrying out the demand response action is increased to 2 to 24 hours the potential increases by about 220 MW.

Demand response of services, commerce and small and medium size industry is slowly proceeding but there is very little reliable public information about this heterogeneous segment. The providers of DER flexibility aggregation services focus mainly on this segment. SEAM provides such customers with DR services in combination with the other end use energy management services. Energiakolmio provides energy market services such as DR aggregation and balance management. Empower IM provides information services for DR aggregation for balance management etc. Electricity retailers, large consumers and possibly some other competitive actors of the electricity market are aggregators in that sense that they include DR in their market portfolio.

Electrical heating is very common in small houses and vacation houses. There is about 1 GW of electrical heating loads in time-of-use control. Smart metering based dynamic demand response is applied in two field tests that each have 10 - 15 MW controllable power during winter, see /Koponen, Pekka; Takki, P; Huusko, R. 2014. Smart Metering Based Demand Response in Finland. Proceedings, Elforsk rapport 14:32, paper 9.6. NORDAC. NORDAC 2014, The 11th Nordic Electricity Distribution and Management Conference 2014, Stockholm, Sweden, 8 - 9 September 2014./

Residential demand response based on a Home Energy Management System (HEMS) and dynamic price control is commercially available for consumers in Finland from several electricity retailers and it is slowly increasing in penetration and may soon reached significant quantities. In these systems the technology is provided by There Corporation.

There reasons for the slower progress of dynamic demand response in the residential segment as compared with the segments of bigger customers include the following. 1) Although the legislation requires load control outputs in all the compulsory smart meters, very many outputs were not connected to any loads during the meter rollout. Not even in situations where the old meter was connected to loads. Thus about one third of the time-of-use loads are not controllable via the smart meters. 2) The electricity retailers and DR-aggregators have learned that large amounts of purely reactive DR will cause high balancing errors that are costly and thus reactive DR becomes unprofitable; it is instead necessary to forecast the responses and bid them to the spot market. Response forecasting models are missing and need to be developed. 3) Most (but not all) smart metering systems have communication latencies of several hours and are thus unsuitable for the provision of DR to the faster electricity markets. Accurate response forecasts are also needed in the faster markets. 4) All smart metering systems claim to support demand response and load control, but only some of them support automated dynamic demand response. Without fully automated operation the small customer demand response is not feasible. 5) Home and building automation systems are for most modern houses too expensive to be paid back mainly by DR. Forecasting the responses of price control is even more challenging than with direct load control.

In Finland demand response is market based, because 1) the distribution networks are relatively strong and 2) the rules are missing on how to combine the network DR interests and the market DR interests. But increasing penetrations of DG, RES, EV and DR will make it necessary to solve this challenge, but not as

soon as in some other countries. Around the world some solutions have been developed and demonstrated, but the regulators have not accepted them.

The Smart Energy Demand Coalition (SEDC) reviewed the situation of aggregated demand response in Europe, see http://sedc-coalition.eu/wp-content/uploads/2014/04/SEDC-Mapping_DR_In_Europe-2014-04111.pdf . It considered that in Europe there are only Finland and 5 other countries where aggregated demand response is commercially active.

Energy efficiency

There is not much to add to the situation review of 2013.

The energy efficiency law HE 182 was given on 9 October 2014 to implement the energy efficiency directive by the European Commission. Large enterprises are required to have energy audits every 4 year. The law addresses also energy measurement, settlement and feedback information.