Energy briefing

European regional adequacy

LESSONS FROM AUSTRALIA

The European Commission's Winter Package focuses on ensuring resource adequacy and promoting regional co-ordination. A regional approach to resource adequacy and system operation can create savings, for instance if "spare" generation can be shared between countries. But an effective regional approach requires a carefully defined policy framework. Without this, it can create new risks. In this briefing we consider lessons for the policy framework in Europe from events in South Australia

A REGIONAL APPROACH

The Winter Package from the EC requires all TSOs to establish Regional Operation Centres (ROCs), with responsibilities which include:

- sizing of regional reserve capacity;
- week ahead to intraday system adequacy forecasts and preparation of risk reducing actions;
- identification of regional crisis scenarios;
- assessment of transmission system operators' defence and restoration plans; and
- coordination and optimisation of regional restoration.

The package also requires ENTSO-E to carry out a European resource adequacy assessment every year, and also requires Member States to monitor resource adequacy within their territory based on the European resource adequacy assessment. This formulation attempts to leave final responsibility for resource adequacy and for real time system operation at the Member State level, while overlaying related responsibilities at the European level.

To date, as the chart below indicates, it has largely been the case that sufficient resources exist in each Member State to meet reasonable expectations of peak demand (with some issues recently arising in France and Belgium in situations with extreme heat or cold).

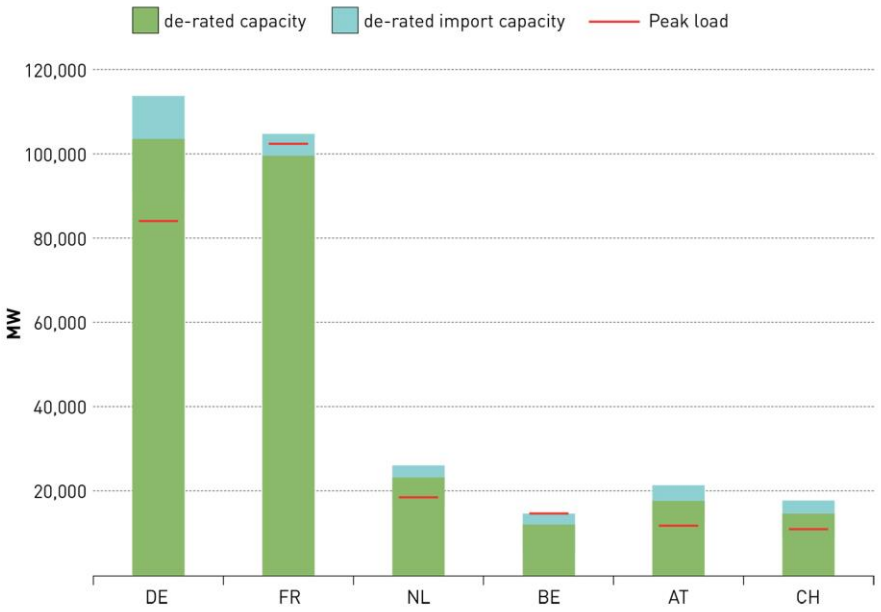
The EC's proposals can be read as signalling a clear move in a different direction.

For a genuinely regional approach to resource adequacy to work, it is important that:

- there is a clear definition of a regional adequacy standard and its translation into MW of resource required;
- there are regional mechanisms in place to ensure the adequacy standard is met; and
- there is a regional approach to operation in the event of an emergency.

Absent regional mechanisms today, a key question is the degree of harmonisation among existing Member State approaches.

Exhibit 1. Peak demand compared to national generation capacity



Source: Frontier Economics

Clear definition of standards

Where adequacy standards have been defined, there has been some degree of coherence among national adequacy standards. For example, France, GB and Belgium have all adopted a standard defined by 3 hours of Loss of Load Expectation (LOLE) per year. The Netherlands has a standard of 4 hours of LOLE.

Similarly, a common approach to defining the MW of resources required for a given LOLE standard is emerging, with a consistent approach to dealing with interconnections. It is clear, though, that this approach is complex and involves a number of subjective judgements, such as:

- the evolution of demand;
- the rate of RES build out and the technology mix;
- evolution of thermal plant reliability;
- hydrological developments and risk; and
- correlation of demand and other variables across countries.

Mechanisms to ensure standard is delivered

There is far less coherence in terms of the design of mechanisms to ensure that adequacy standards are met.

At the highest level, countries can be differentiated according to whether or not they have implemented or plan to implement Capacity Remuneration Mechanisms (CRM). For example, Germany has decided to continue with an Energy Only Market (though with some new elements of reserve), France has opted for a market-wide CRM, and Belgium has opted for a Strategic Reserve.

This alone might imply free riding – if one country ensures adequacy via a CRM, this might enhance system security for its neighbours, with the cost only being recovered nationally. This in turn may create unhelpful incentives for policymakers.

Further differences appear at the detailed design level. For example, CRMs differ in relation to the definition of what providing capacity means. In some mechanisms it means simply having capacity available, and in others it means delivering at times of system stress. Mechanisms also differ in relation to the incentives to provide capacity, usually defined by the penalties charged if capacity is

unavailable. Market behaviour in some countries has made it clear that even if capacity is contracted, the incentives may not be strong enough to ensure that capacity is actually built[1].

There are also differences in policies which impact the investment climate and hence the risks of market failure vary significantly between countries. Some countries have set out clear policies to try to ensure investors respond to market requirements. For example, there is evidence of governments making a range of changes, including removing price caps or making clear they will not be introduced, setting out clear paths for RES investment so that thermal plant know the market they will be serving, and ensuring "investor friendly" regulatory frameworks. However, such actions are not universal. Yet interconnection means that wholesale prices can be correlated, which in turn means that there can be regional "contagion". "Bad practice" government policy in one country can lead to risks for investors in neighbouring systems, and hence an increase in the risk of regional market failure.

Regional approach to emergency management

It is unclear as to what will happen in an emergency situation.

In terms of planning for emergencies, the Winter Package:

- allocates some responsibilities ahead of time to ROCs, such as reserve procurement and identification of crisis scenarios; but
- leaves real time restoration to national TSOs (with co-ordination and optimisation by ROCs).

The Winter Package also includes a new regulation on risk-preparedness, which requires that:

- "Member States shall act and cooperate in a spirit of solidarity in order to prevent and manage electricity crisis situations, with a view to ensuring that electricity is delivered where it is most needed with a view to protecting public safety and personal security"; and
- "Where necessary and possible Member States shall offer each other assistance to prevent or mitigate an electricity crisis. Such assistance shall be subject to compensation."

While this establishes a principle of support "where necessary and possible", in the heat of an emergency situation, this may leave more discretion to individual operators and national governments than desirable.

LESSONS FROM AFAR

While the EC has been drafting its Winter Package, an interesting "natural experiment" has been going on in South Australia which provides lots of food for thought.

South Australia is a small system, which has over time seen increasing renewables penetration. For years, planning in the Australian National Electricity Market has been at the regional level, with the assumption that at least c. 200MW of South Australia's native demand will be satisfied through imports from other states at time of peak demand.

Over time, South Australia has seen increasing levels of RES penetration, which have affected both the level and volatility of wholesale prices. Prices have become more volatile as a result of an increasing dependence on intermittent generation that is not correlated to demand (the wind blows at night and not during heat waves). Increasing entry by low variable cost wind generation initially acted to suppress prices. However, with the exit of traditional baseload power, price levels have risen reflecting the greater need for higher cost gas-fired generation and imports into SA. Numerous commentators (including Frontier) noted the impact of intermittency on price formation, and the potential implications for security of supply[2].

In June 2015, Alinta Energy announced the permanent closure of the Flinders Power Stations – Northern and Playford. The plants closed in May 2016. This represented the exit of the only major baseload power station in South Australia, with 520MW of capacity.

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[1] A number of plants that won capacity agreements in GB have subsequently "reneged" on these agreements and incurred penalties, including a large new build CCGT plant.

[2] See for example http://www.frontier-economics.com.au/documents/2015/07/out-of-puff.pdf

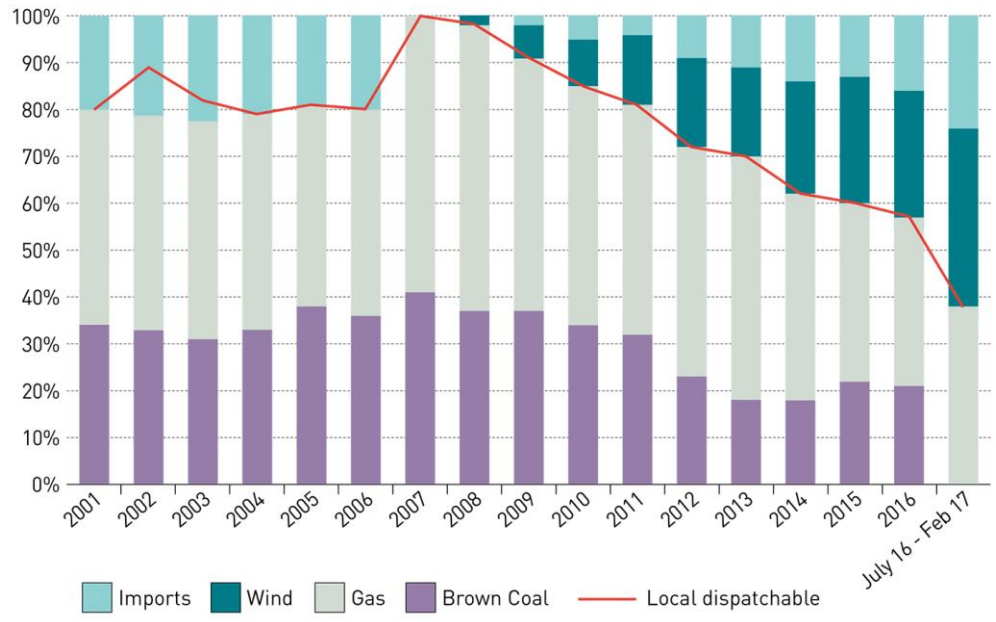
Even before the plant actually closed, Frontier's modelling showed that South Australia would rely heavily on intermittent renewables generation and interconnection for security of supply. In 2013 an upgrade of the Heywood interconnector (between South Australia and Victoria) from 460 MW to 650 MW was approved based on its "net economic benefits". In essence, the upgrade was seen as enabling an increase in output from lower operating cost and low emission generation sources, in turn displacing output from higher operating cost and/or higher emission generation sources.[3]

The institutional setting for the South Australian market is also relevant. The Australian Electricity Market Operator (AEMO) has a number of key responsibilities in the market, distinct from the owner of the transmission system, ElectraNet. The AEMO is responsible for:

- network planning for the States of South Australia and Victoria (the States linked by Heywood and Murraylink interconnectors);
- system operation (including oversight of the fault settings on power plants);
- determining which system events are "credible contingencies" and which are not. This is important as AEMO will take steps in dispatching the market to act more conservatively with a credible contingency, whereas they will not change their behaviour if a contingency is not credible;
- ancillary service contracting (including definition and procurement of black start capability); and
- ex post investigations of system events[4].

As Exhibit 2 shows, South Australia is in many ways a good example of reliance on regional adequacy. Imports are critical to the system in terms of meeting peak demand. However, it is also a good example of what can go wrong.

Exhibit 2. South Australia generation mix



Source: Frontier Economics

[3] South Australia – Victoria (Heywood) Interconnect Upgrade, RIT-T project Assessment Conclusions Report, January 2013, pg. v. http://www.aemo.com.au/media/Files/Other/planning/RITTs/SA_VIC_Heywood_Interconnector_Upgrade_RIT_T_PACR.pdf

[4] Although the Australian Energy Regulator has the responsibility for reviewing whether AEMO has adhered to the Market Rules and, in some cases the Australian Energy Markets Commission (the rule making body) may also choose to investigate whether AEMO and the AER have met their obligations under the National Electricity Law and Market Rules

On 28 September 2016, a major storm hit the state. In spite of the fact that AEMO knew of the severity of the approaching storm well ahead of time, AEMO did not believe that it was a credible contingency that South Australia would be separated from the rest of the National Electricity Market. As such they operated the system as they would under 'system normal' conditions. This meant that they allowed the newly upgraded Heywood interconnect to be fully loaded with imports into South Australia from Victoria. They scheduled no frequency control ancillary services in South Australia, assuming these would be supplied over the interconnector. At the time only a few local thermal generators were operating and therefore there was a limited supply of local inertia.

In the event, the storm led a number of power lines in the state being blown over. This created voltage instability in the system, which in turn led a number of wind farms to disconnect from the grid in quick succession, as a result of the way in which their fault ride-through equipment was configured. The large and rapid reduction in wind production led to an increase in imports over the Heywood interconnector. There was little local inertia to provide the necessary resilience to allow time to fire up local generators to provide frequency control and voltage stability. The Heywood interconnector quickly overloaded by around 150% and, as a consequence, tripped. The sudden loss of the supply to South Australia resulted in a voltage collapse and the small amount of local generation tripped which led to a state-wide blackout.

Full restoration of the grid took 52 hours. It was hampered by the physical damage done by the storm to the network but also by some of the arrangements which had been put in place for black start. There were two principal black start providers. One was in the wrong place to be of any use, and the second was unable to provide sufficient power to restart bigger power stations. Eventually, the system was restored with power from the Victorian interconnector once an electrical path could be established from Victoria to a major gas fired generator close to Adelaide.

In Australia, many of the national political issues which are relevant in Europe do not exist. Even so, experience from South Australia highlights some important challenges in relation to clarity of governance and technical capabilities. It is to these which we now turn.

IMPLICATIONS FOR EUROPE

A strong move in the direction of regional assessment of adequacy in the European context raises questions at various levels.

The first, and perhaps most important, question is political in nature. A regional treatment of adequacy implies regional pooling of capacity. In the majority of situations, this may not create any issues. It is reasonable to assume that if one European country is experiencing system stress and there is spare capacity in a neighbouring country, the spare capacity will be used to meet demand in the system experiencing stress.

A more critical question is what happens when both (or several) countries are experiencing stress. A regional approach should imply some degree of "burden sharing". For example, perhaps those customers across the region with the lowest willingness to pay for continuity of demand should be interrupted first. What it should not imply is that interconnector flows are cut, so that domestic capacity automatically serves only the domestic market. However, in an emergency situation there will inevitably be political pressure in this direction[5]. This immediately undermines any regional approach, because it means that the location of capacity still determines to whom it ultimately provides security.

If European legislation is to point to greater reliance on regional adequacy, then it must also provide for greater clarity in relation to emergency events, in particular, finding a way to control inevitable political pressure in the heat of the moment. Doing one but not the other creates rather than solves problems.

[5] In Australia, the National Electricity Market is under a common system operator and a common dispatch engine. AEMO has not historically had an allegiance to a particular state, so while it may have discretion over the specification of despatch constraints, it is unlikely that it would use this to "allocate" scarcity in stress conditions (whether this remains the case now it is system planner for some states remains to be seen).

A second question relates to governance. If South Australia demonstrates anything, it is that crisis planning and emergency management needs clear and objective decision making. Conflicts of interest and split responsibilities can jeopardise supply security.

For example, if those responsible for adequacy assessment are conflicted in relation to some of the many subjective judgements which are required (such as the reliability of interconnections) then inputs may be less than objective. And this in turn may mean that the wrong decisions are taken.

Similarly, if responsibility for tasks which are closely interrelated is split, there is a heightened risk of lack of co-ordination at best. At worst, the impact of one party's decisions on actions which are the responsibility of another party will not be properly taken into account, resulting in the whole process failing.

A third and related question is that of capabilities. Operating the real time electricity system requires deep technical understanding. For example, in South Australia, AEMO was formally responsible for oversight of generation voltage fault ride-through settings, and these turned out to be configured in such a way as to worsen rather than improve things when it mattered. In critical areas such as system security, responsibility must be accompanied by resources and capabilities to deliver upon them.

A final question relates to harmonisation. The rules around the NEM in Australia are fully harmonised. As we note above, this is not the case across European jurisdictions. In some areas, lack of harmonisation may not be critical. But in others, it may imply "free riding" (some countries benefiting from adequacy paid for by others) or, at worst, greater incentives on capacity to deliver to support some stress events than others. Details such as the penalties applied in capacity remuneration schemes or the level of imbalance prices in a country compared to other countries might have a dramatic influence on how participants act in stress situations. A frank assessment of the impacts of lack of harmonisation is required.

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