swissgrid

Contributions to the Market Design for the Swiss Energy Strategy 2050

Consultation Document

Imprint

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Management summary

European electricity markets are undergoing enormous changes. Innovative energy technologies are replacing conventional systems, new participants are entering the market, and new patterns have arisen in sales and trading. The European Union and its member states are partly driving these changes, implementing reforms for a low-carbon transition, and a single energy market. Under its national Energy Strategy 2050, Switzerland faces comparable upheaval, with similar implications for market design.

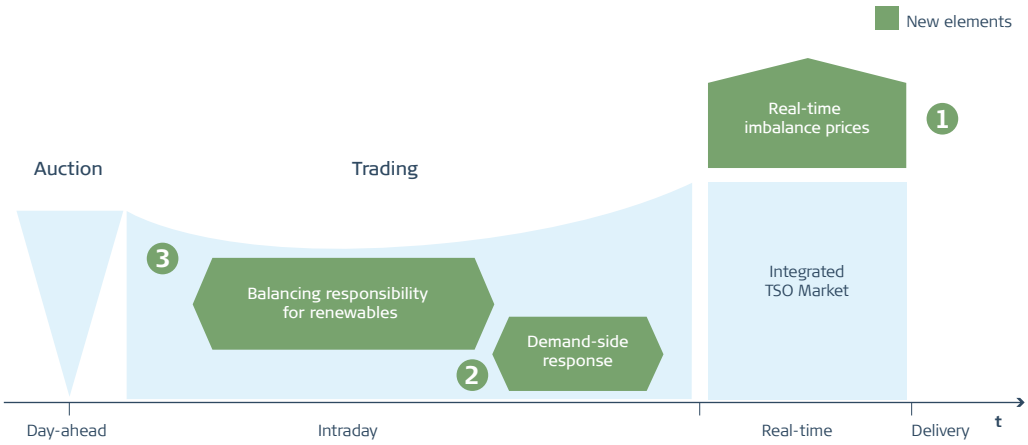
Following constructive, in-depth discussions with multiple stakeholders, Swissgrid is publishing this informal consultation on market reform, for all relevant participants. The consultation is written in English, to allow European partners to participate in the discussion, and choose whether to adopt or adapt similar reforms. The consultation proposals should improve the operation of the Swiss electricity market with a five-year horizon. The consultation forms the central part of a transparent decision-making process, to define a joint way forward.

In this consultation, Swissgrid recognizes the merits of existing market design principles, such as the «energy only market», efficient trading mechanisms and the European integration of electricity markets. We aim to combine and enhance such concepts, for a consistent, market-based, resilient approach.

The proposed reforms focus on three themes:
» Improve the price signal
» Optimise cross-border trading
» Move towards a regional approach for security of supply

For each theme, we propose three specific measures, relating to Swissgrid's tasks and responsibilities for managing balance groups and cross-border congestion, as well as securing stable grid operations. As the design of the specific measures in the third theme largely depends on further co-operation with the European Union, these are described at a more conceptual level for now. Other on-going related projects, such as OSTRAL, the pooling concept and the Integrated TSO Market, are not the focus of this consultation.

Improve the price signal



The figure illustrates, in blue, the sequence of markets for energy trading across time from day-ahead to delivery. The proposals, in green, include: (1) the introduction of new real-time imbalance prices, (2) measures to enable demand-side response and (3) the introduction of balancing responsibility for renewables.

At present, prices in the Swiss wholesale market do not represent the true value of system resources, and in particular their flexibility and support for system adequacy. We define «flexibility» as the capability of a system to balance rapid changes in renewable generation and forecasting errors. Several options exist to provide flexibility, where a comparative evaluation can establish the most cost-effective mix of technologies.[1] The term «adequacy» expresses the ability of the electricity system to supply the aggregate demand requirements of end-use customers at all times, taking into account scheduled and reasonably expected, unscheduled outages.[2]

Inefficient price signals ultimately endanger supply adequacy, because they may lead to insufficient investment in relevant technologies and thus prevent a market-based development of the electricity system. Swissgrid therefore proposes several measures to increase the efficiency of the price signal.

First, Swissgrid envisages a new, real-time imbalance price regime, building on the Integrated TSO Market. The Integrated TSO Market has been proposed as a market-based solution for manually activated system service products, such as tertiary control energy or redispatch. This approach would integrate in a single market various contracts of the TSO for system balancing and congestion management. The new imbalance price regime would reference to the prices in the Integrated TSO Market, providing a real-time price signal which reflects actual scarcity in the system. To fortify this price signal, prices would be published closer to real time. In addition, the introduction of market-based or administrative scarcity pricing could allow price increases during tight balancing situations, thus further strengthening the signal.

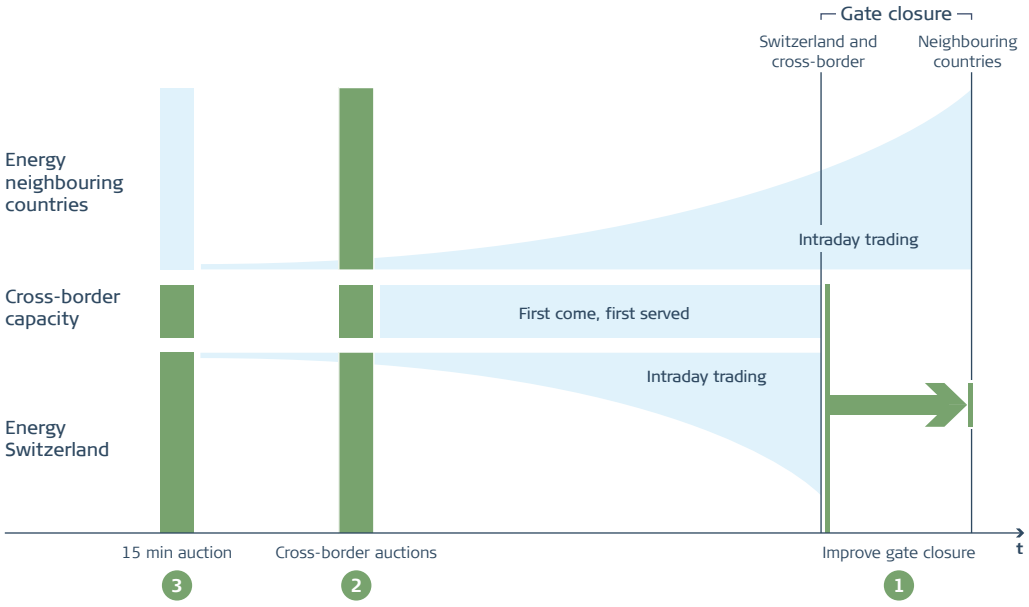
1 Institute of Energy Economics (EWI) (2012) Flexibility Options in European Electricity Markets in High RES-E Scenarios. Study on behalf of the International Energy Agency (IEA), University of Cologne, Final Report, October 2012, p. 1. Available online at: http://www.ewi.uni-koeln.de/fileadmin/user_upload/Publikationen/Studien/Politik_und_Gesellschaft/2012/Flexibility_options_in_the_European_electricity_markets.pdf

2 North American Electric Reliability Corporation (NERC) (2015) Glossary of Terms Used in NERC Reliability Standards. Updated December 3, 2015, p. 5. Available online at: http://www.nerc.com/pa/stand/glossary%20of%20terms/glossary_of_terms.pdf

Second, Swissgrid is considering extending the present concept for pooling multiple flexible generation and consumption units as single, virtual generating units. Such a concept already applies in the TSO market and could be extended to the wholesale market by introducing a role for a new, independent aggregator for such flexible units. Such a step may provide an additional driver to scale up demand-side response. However, it may also severely complicate Swiss market processes. In addition, numerous initiatives are already underway to support demand-side response at the retail and distribution system operator level.

Third, Swissgrid welcomes the suggestions of the Swiss Energy Office to move towards balancing responsibility for new renewable energy providers. Today, renewables are subsidized under a cost-covering remuneration for feed-in to the electricity grid (CRF). Under this scheme they receive a fixed remuneration for each kilowatt hour (kWh) they produce, independent of market conditions. Market prices could better account for variable renewables, such as wind and solar power, if suppliers had to meet forecast output in the same way as conventional power generation and market their production jointly with other sources.

Optimise cross-border trading



The figure illustrates, in blue, the trading volumes in the intraday markets for energy and cross-border transmission rights. The proposals include: (1) an alignment of cross-border gate closure times with neighbouring countries, (2) the introduction of cross-border auctions to complement today's first-come, first-served allocation of transmission rights and (3) the participation of Switzerland and possibly Austria in German 15-minute intraday call auctions.

Switzerland is hugely impacted by on-going electricity system changes in Europe. The country has about 40 cross-border electricity connections, which total about 9 gigawatts (GW) of power capacity. Cross-border flows in Switzerland represent around 10% of the entire cross-border flows in the total synchronized European continental grid. However, political delay in settling the «Bilateral Negotiations» between Switzerland and the EU has

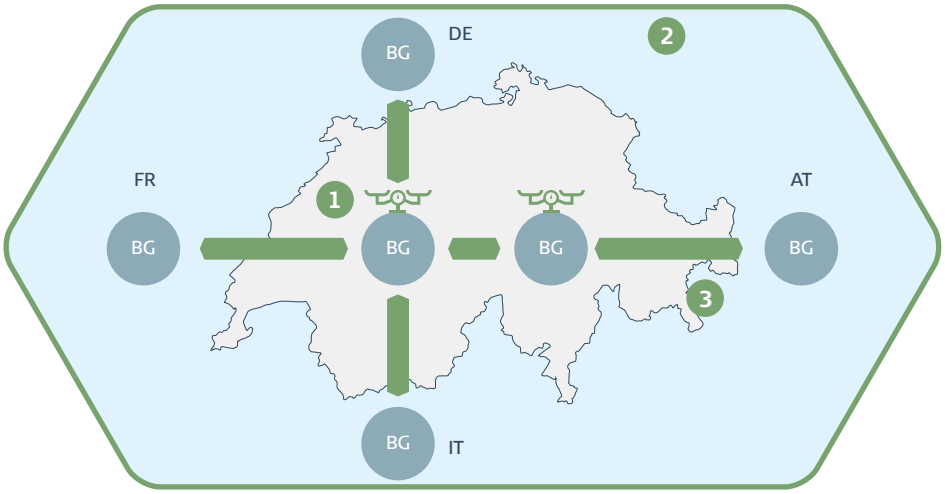
led to rising isolation of Switzerland from the European «integrated energy market». As a result, Swissgrid is increasingly focusing on incremental improvements, and proposes three specific measures to facilitate cross-border trade. These are expected to have a higher chance of short-term realisation, although the relationship between the EU and Switzerland may yet pose an obstacle, given its critical impact on cross-border trade.

First, Swissgrid proposes to reduce the intraday, cross-border gate closure times on its borders with Germany and Austria, as well as the corresponding closure time for trading within Switzerland, towards 30 minutes before real time, reflecting current trading times in the German and Austrian intraday markets. Such a harmonization would lead to a closer market integration at the intraday level. This could create benefits for all market participants. The German, Austrian and Swiss intraday markets would have greater opportunities to exchange flexibility, and benefit from additional liquidity for short-term orders. The main implementation challenge would be to ensure compatibility with international TSO processes and regulations, such as network codes, which are highly inter-dependent.

Second, an intraday opening auction for cross-border transmission rights and electricity on Switzerland's northern borders could address the increasing significance of intraday markets for system optimization. Such an auction would be in addition to present, continuous intraday trading, as well as the expected implementation of the European cross-border intraday project (XBID). It would ensure a more efficient allocation of cross-border transmission rights compared with today's «first-come, first-served» allocation principle.

Third, a joint 15-minute intraday call auction covering Switzerland, Germany and possibly Austria would present a further opportunity to improve the exchange of flexibility between these countries. Such a joint, multi-lateral auction for 15-minute products and related transmission rights for the following calendar day would build upon the success of the present intraday call auction in Germany. This new auction, which has been introduced by EPEX SPOT in 2014, already accounts for more than half of the total trading volume for German intraday 15-minute contracts.

Move towards a regional approach for security of supply



The figure illustrates the responsibilities of balance groups (BG) within and outside Switzerland for security of supply. The proposals include: (1) strengthening the balancing responsibility within Switzerland, (2) improving regional and European co-operation on security of supply and (3) measures to enable cross-border trading of adequacy.

TSOs face rising challenges to ensure security of supply. A well-functioning market provides the best basis for stable, real-time grid operations. However, recently there has been a growing number of national discussions on supply adequacy which have led to the introduction of a variety of different national capacity mechanisms. The resulting patchwork risks distorting the European energy market. Swissgrid therefore seeks to move towards a market based, regional approach on security of supply, with the following three measures.

First, Swissgrid seeks to increase the responsibility of balance groups for achieving generation adequacy. Such an approach contrasts with a more centralised regime, where the state or TSO bears such responsibility. Increasing the balancing responsibility of balance groups, for example through incentives to hedge against future market illiquidity or adequacy problems, would add to efficient long-term investment signals.

Second, Swissgrid proposes greater co-operation on security of supply, and especially the provision of adequacy, at the regional and European level. Such broader co-operation would be preferable to today's largely national approaches, which may result in an overcapacity in conventional generation. Co-operation would also support the development of a more efficient price signal for the supply of flexibility.

Finally, balance groups should have the opportunity to hedge adequacy risk across borders. TSOs could provide security on the long-term availability of cross-border transmission capacity required for participation in international capacity mechanisms. For countries without a capacity mechanism, the cross-border hedging of adequacy could be enabled by the introduction of interconnected markets for hedging contracts, such as physically-backed option contracts.

Next steps in the consultation

Swissgrid is convinced that these proposed measures will improve the efficiency and security of electricity markets, and so boost resilience in the face of future challenges. In addition, the proposed measures, including improved price signals, optimized cross-border trade and a regional approach to security of supply, will create new opportunities for all market participants, from grid operators to suppliers, generators and end customers.

We greatly look forward to discussing these proposals with all relevant stakeholders. We therefore invite your feedback on the enclosed consultation questions by February 16th, 2016. Based on the outcome of the consultation and follow-up processes, we aim to take timely steps towards the implementation of the proposed new market design for the Energy Strategy 2050.

In order to participate in the consultation, please use the login details that we have provided or email us at: **consultation.marketdesign@swissgrid.ch**

Zusammen-fassung des Berichts

Die europäischen Strommärkte unterliegen einem enormen Wandel. Innovative Energietechnologien ersetzen konventionelle Technologien, neue Teilnehmer treten in die Märkte ein und der Vertrieb sowie Handel verändern sich. Die Europäische Union und ihre Mitgliedsstaaten befördern diese Entwicklungen, mit ihren Reformen für den Übergang zu einem geringen CO_2-Ausstoss und einem europäischen Binnenmarkt für Energie. Gemäss ihrer nationalen Energiestrategie 2050 sieht sich die Schweiz einem vergleichbaren Umbruch gegenüber, mit entsprechenden Auswirkungen auf das Marktdesign.

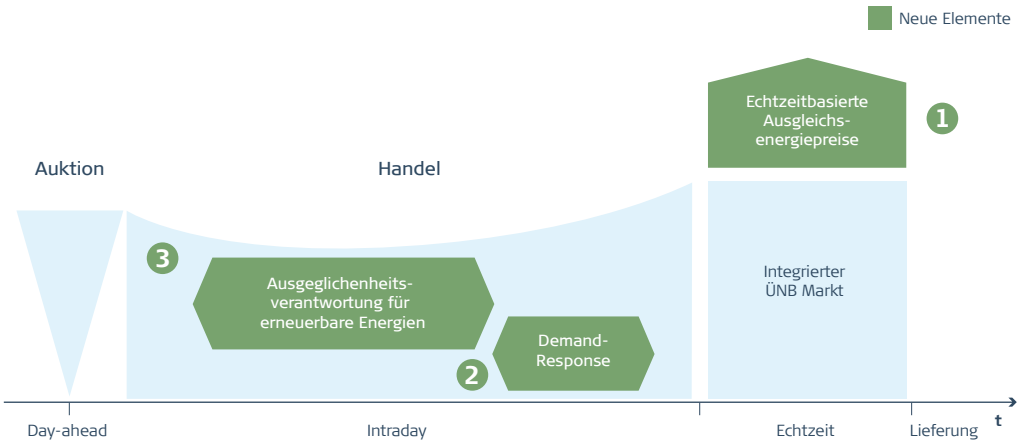
Nach konstruktiven und eingehenden Gesprächen mit verschiedenen Anspruchsgruppen veröffentlicht Swissgrid eine informelle Konsultation zur Marktreform für alle relevanten Teilnehmer. Das Konsultationsdokument ist in Englisch abgefasst, um allen europäischen Partnern die Möglichkeit zu geben, sich an der Diskussion zu beteiligen und zu entscheiden, ob sie ähnliche Reformen einführen oder anpassen wollen. Die Vorschläge dieser Konsultation sollen die Effizienz und Sicherheit des schweizerischen Strommarkts innerhalb der kommenden fünf Jahre verbessern. Die Konsultation bildet das zentrale Element eines transparenten Entscheidungsfindungsprozesses, bei dem es darum geht, einen gemeinsamen Weg für die nächsten Jahre festzulegen.

In dieser Konsultation erkennt Swissgrid die Verdienste bestehender Marktdesign-Grundsätze an, wie zum Beispiel diejenigen des «Energy-only-Marktes», effizienter Handelsmechanismen und der europäischen Integration der Strommärkte. Wir zielen darauf ab, derartige Konzepte zu kombinieren und zu verbessern, um einen stimmigen, marktbasierten, belastbaren Ansatz zu entwickeln.

Die vorgeschlagenen Reformen konzentrieren sich auf drei Bereiche:
» Stärkung des Preissignals
» Optimierung des grenzüberschreitenden Handels
» Entwicklung eines regionalen Ansatzes für Versorgungssicherheit

Für jeden der Bereiche werden drei spezifische Massnahmen vorgeschlagen. Diese Massnahmen entsprechen der Verantwortung von Swissgrid für das Management von Bilanzgruppen, das grenzüberschreitende Engpassmanagement sowie für die Aufrechterhaltung eines stabilen Netzbetriebs. Da die Entwicklung spezifischer Gestaltungsvorschläge für den drittgenannten Punkt stark von der weiteren Kooperation mit der Europäischen Union abhängt, werden diese derzeit auf einem stärker konzeptionellen Niveau dargestellt. Andere laufende verwandte Projekte wie zum Beispiel OSTRAL, das Pooling-Konzept sowie der integrierte Übertragungsnetzbetreiber-Markt, stehen nicht im Fokus dieser Konsultation.

Stärkung des Preissignals



Der blau unterlegte Teil dieser Abbildung veranschaulicht den Ablauf des Elektrizitätshandels im Zeitverlauf von der Day-Ahead-Auktion bis zur Lieferung. Die grün hervorgehobenen Änderungsvorschläge umfassen (1) die Einführung neuer Echtzeitpreise für Unausgeglichenheiten, (2) bessere Voraussetzungen für Demand-Response und (3) die Ausgeglichenheitsverantwortung für erneuerbare Energien.

Derzeit repräsentieren die Preise auf dem schweizerischen Grosshandelsmarkt für Elektrizität nicht den wahren Wert der Systemressourcen. Insbesondere die Erzeugungsflexibilität und deren Beitrag zur Adäquanz wird nicht ausreichend anerkannt. Wir definieren «Flexibilität» als die Fähigkeit eines Systems, schnell auf Veränderungen in der Stromerzeugung durch erneuerbare Energien und Prognosefehler zu reagieren. Es gibt verschiedene Optionen, um Flexibilität zu schaffen, wobei anhand einer vergleichenden Beurteilung der kostengünstigste Technologiemix bestimmt werden kann.[3] Der Begriff «Adäquanz» drückt die Fähigkeit des Elektrizitätssystems aus, unter Berücksichtigung von geplanten und realistisch zu erwartenden ungeplanten Ausfällen jederzeit die gesamte Nachfrage der Endkunden zu decken.[4]

3 Energiewirtschaftliches Institut an der Universität zu Köln (2012): Flexibility options in European electricity markets in high RES-E scenarios – Study on behalf of the International Energy Agency (IEA), Köln, 2012, S. 1.
4 North American Electric Reliability Corporation (NERC) (2015): Glossary of Terms Used in NERC Reliability Standards, Aktualisiert am 17. November 2015, S. 5.

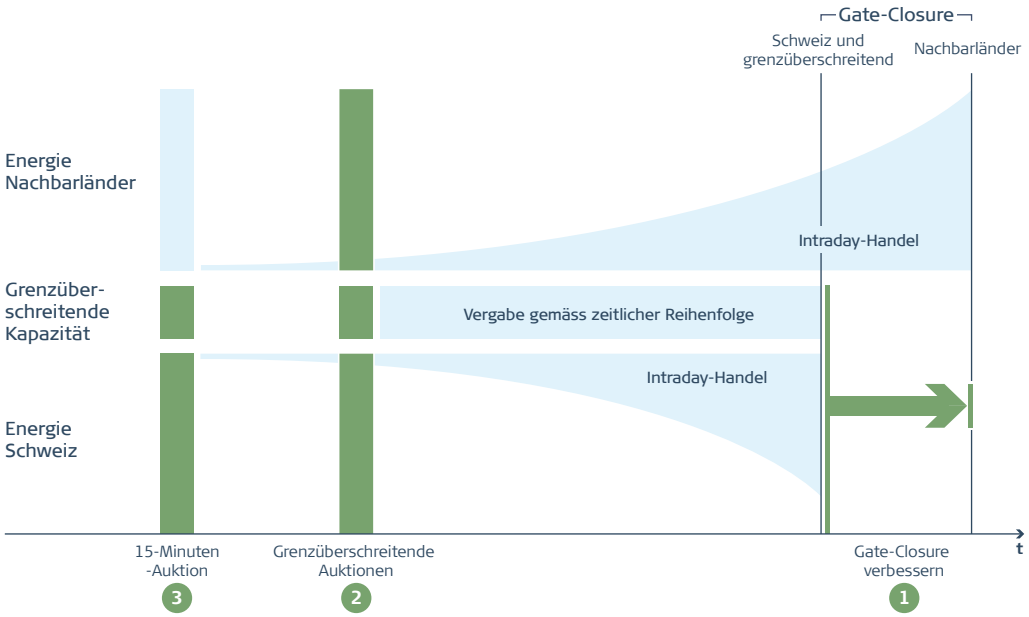
Ineffiziente Preissignale gefährden den Erhalt von Adäquanz, da Investitionen in relevante Technologien und damit eine marktbasierte Entwicklung des Elektrizitätssystems nicht mehr sichergestellt ist. Swissgrid schlägt daher mehrere Massnahmen vor, um die Wirkung des Preissignals zu erhöhen.

Erstens erwägt Swissgrid neue echtzeitbasierte Ausgleichsenergiepreise basierend auf dem integrierten Übertragungsnetzbetreiber-Markt (ÜNB-Markt). Der integrierte Übertragungsnetzbetreiber-Markt wurde als marktbasierende Lösung für manuell aktivierte Systemdienstleistungsprodukte wie zum Beispiel Tertiärregelenergie oder Redispatch vorgeschlagen. Er würde es erlauben, verschiedene Verträge des Übertragungsnetzbetreiber-Markt zum Systemausgleich und Engpassmanagement in einem Marktplatz zu vereinen. Die Ausgleichsenergiepreise würden die erzielten Preise im integrierten Übertragungsnetzbetreiber-Markt wiederspiegeln und so ein Echtzeit-Preissignal schaffen, das tatsächliche Knappheit im System widerspiegelt. Um dies zu verstärken, würden die Preise näher zur Echtzeit veröffentlicht. Darüber hinaus könnte eine Einführung von marktbasierten oder administrativen Knappheitspreisen das Zustandekommen von Preissteigerungen in angespannten Versorgungssituationen erlauben und dadurch das Preissignal zusätzlich stärken.

Zweitens untersucht Swissgrid die Möglichkeit, das gegenwärtige Konzept für das Pooling verschiedener flexibler Erzeugungs- und Verbrauchseinheiten auf den Grosshandelsmarkt zu erweitern. Durch die Einführung der Marktrolle eines unabhängigen Aggregators könnten einzelne virtuelle Erzeugungseinheiten auch auf dem Grosshandelsmarkt gebündelt werden und wie bereits heute auf dem Regelenergiemarkt angebots- und nachfrageseitige Flexibilität anbieten. Ein solcher Schritt könnte einen zusätzlichen Treiber für die Verstärkung nachfrageseitiger Reaktionen auf Preissignale (Demand-Response) darstellen. Er würde jedoch auch die schweizerischen Marktprozesse stark verkomplizieren. Darüber hinaus werden bereits zahlreiche Initiativen zur Unterstützung der Nachfragesteuerung auf Endkunden- und Verteilnetzbetreiberebene unternommen.

Drittens begrüsst Swissgrid die Empfehlungen des Bundesamts für Energie, eine Ausgeglichenheitsverantwortung für Erzeuger erneuerbarer Energien anzustreben. Erneuerbare Energien werden heute durch eine kostendeckende Einspeisevergütung (KEV) gefördert, indem eine feste Vergütung für jede Kilowattstunde bezahlt wird, die sie erzeugen, unabhängig von den Marktbedingungen. Marktpreise könnten volatilen erneuerbaren Energien, wie zum Beispiel Wind- und Solarenergie, besser gerecht werden, wenn Anbieter für Abweichungen von der prognostizierten Leistung im gleichen Masse aufkommen müssten wie konventionelle Stromerzeuger und wenn die Energie aus erneuerbaren Quellen gemeinsam mit der Energie aus anderen Quellen am Markt vermarktet würde.

Optimierung des grenzüberschreitenden Handels



Die Abbildung veranschaulicht, in blau, die Handelsvolumen an den Intraday-Märkten für Elektrizität und grenzüberschreitende Kapazitätsrechte. Die Vorschläge umfassen (1) eine Anpassung grenzüberschreitender Gate-Closure-Zeiten, (2) die Einführung von grenzüberschreitenden Auktionen zusätzlich zur bestehenden Vergabe von Übertragungsrechten gemäss der zeitlichen Reihenfolge der Gebotsabgabe und (3) eine Beteiligung der Schweiz und möglicherweise Österreichs an den deutschen 15-Minuten-Intraday-Call-Auktionen.

Die derzeitigen Veränderungen im europäischen Stromsystem haben grosse Auswirkungen auf die Schweiz. Das Land verfügt über rund 40 grenzüberschreitende Stromverbindungen, die insgesamt eine Kapazität von 9 Gigawatt (GW) aufweisen. Grenzüberschreitende Stromflüsse in die Schweiz machen etwa 10 Prozent der gesamten grenzüberschreitenden Stromflüsse im synchronisierten kontinentaleuropäischen Stromnetz aus. Jedoch hat eine politische Verzögerung der «Bilateralen Verhandlungen» zwischen der Schweiz und der EU zu einer zunehmenden Isolierung der Schweiz gegenüber dem europäischen Energiebinnenmarkt geführt. Daher konzentriert sich Swissgrid zunehmend auf graduelle Verbesserungen und schlägt drei spezifische Massnahmen vor, um den grenzüberschreitenden Handel zu erleichtern. Es ist davon auszugehen, dass diese eine höhere Chance für eine kurzfristige Umsetzung aufweisen, auch wenn die Beziehungen zwischen der EU und der Schweiz hierfür ebenfalls von entscheidender Bedeutung sein werden.

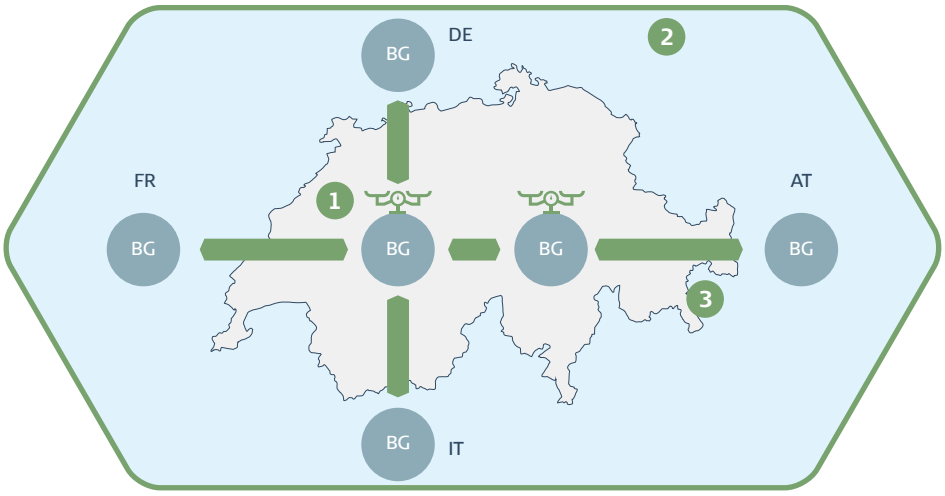
Erstens schlägt Swissgrid vor, die grenzüberschreitenden Intraday-Gate-Closure-Zeiten an den Grenzen zu Deutschland und Österreich sowie die Vorlaufzeiten für den innerschweizerischen Handel soweit möglich auf 30 Minuten vor Echtzeit zu reduzieren, was den derzeitigen Vorlaufzeiten im deutschen und österreichischen Intraday-Markt entsprechen würde. Eine derartige Konvergenz würde eine engere Marktintegration auf der Intraday-Ebene bewirken. Dies könnte für alle Marktteilnehmer Vorteile schaffen. Die deutschen, österreichischen und schweizerischen Teilnehmer der Intraday-Märkte bekämen bessere Möglichkeiten zum Flexibilitätsaustausch, während die Märkte von zusätzlicher Liquidität für kurzfristige Geschäfte profitieren würden. Die Hauptschwierigkeit bei der Umsetzung läge darin, die Kompatibilität mit internationalen Übertragungsnetzbetreiberprozessen

und -regelungen zu gewährleisten, wie zum Beispiel Network Codes, die in hohem Masse voneinander abhängig sind.

Zweitens könnte eine Intraday-Eröffnungsauktion für Energie und Übertragungsrechte an der Nordgrenze der Schweiz der zunehmenden Bedeutung der Intraday-Märkte für die Systemoptimierung Rechnung tragen. Eine solche Auktion wäre eine Ergänzung zum derzeitigen kontinuierlichen Intraday-Handel sowie zur erwarteten Umsetzung des europäischen, grenzüberschreitenden Intraday-Projekts (XBID). Mittels der Auktion könnte eine effizientere Zuteilung grenzüberschreitender Kapazitätsrechte erreicht werden als beim bestehenden Allokationsverfahren, bei welchem die Rechte ausschliesslich auf der Grundlage des Zeitpunkts der Gebotsabgabe vergeben werden.

Drittens könnte eine gemeinsame 15-Minuten-Intraday-Call-Auktion zwischen der Schweiz, Deutschland und möglicherweise Österreich eine weitere Gelegenheit bieten, den Austausch von Flexibilität zwischen diesen Ländern zu verbessern. Eine solche gemeinsame, multilaterale Auktion für 15-Minuten-Produkte sowie für die entsprechende Grenzkapazität würde auf den Erfolg der aktuellen Intraday-Call-Auktion in Deutschland aufbauen. Diese von EPEX SPOT 2014 eingeführte Auktion umfasst bereits heute über die Hälfte des gesamten deutschen 15-Minuten-Intraday-Handelsvolumens.

Entwicklung eines regionalen Ansatzes für Versorgungssicherheit



Die Abbildung veranschaulicht die Verantwortlichkeiten von Bilanzgruppen (BG) für die Versorgungssicherheit innerhalb und ausserhalb der Schweiz. Die Vorschläge umfassen (1) eine Stärkung der Ausgeglichenheitsverantwortung der Bilanzgruppen in der Schweiz, (2) die Verbesserung der regionalen und europäischen Kooperation im Bereich Versorgungssicherheit und (3) Massnahmen, Versorgungsrisiken grenzüberschreitend abzusichern.

Übertragungsnetzbetreiber sehen sich steigenden Herausforderungen bei der Gewährleistung der Versorgungssicherheit gegenüber. Ein gut funktionierender Markt ist die beste Grundlage für einen stabilen Netzbetrieb in Echtzeit. In jüngster Zeit sind jedoch in Europa vermehrt nationale Diskussionen über die Sicherstellung von Adäquanz zu beobachten. Diese haben zur Einführung von verschiedenen nationalen Kapazitätsmechanismen

geführt; dieses Stückwerk stellt die Effizienz des europäischen Energiemarktes in Frage. Swissgrid strebt daher an, durch die folgenden drei Massnahmen auf einen marktbasierten, regionalen Ansatz für Versorgungssicherheit hinzuarbeiten.

Erstens möchte Swissgrid die Verantwortung von Bilanzgruppen für das Erreichen einer angemessenen Adäquanz erhöhen. Ein solcher Ansatz steht im Gegensatz zu einem stärker zentralisierten Regime, bei dem eine derartige Verantwortung beim Staat oder beim Übertragungsnetzbetreiber liegt. Die Ausgeglichenheitsverantwortung von Bilanzgruppen zu stärken, etwa durch Anreize zur Absicherung gegen künftige Marktilliquiditäts- oder Versorgungsprobleme, würde wirksame langfristige Investitionssignale setzen.

Zweitens schlägt Swissgrid eine verstärkte Kooperation im Bereich der Versorgungssicherheit und insbesondere bei der Bereitstellung angemessener Erzeugungskapazitäten auf regionaler und europäischer Ebene vor. Eine breitere Kooperation wäre den heutigen, weitgehend nationalen Ansätzen vorzuziehen, da diese zu Überkapazitäten führen können. Kooperation würde auch die Entwicklung eines wirkungsvolleren Preissignals für die Bereitstellung von Flexibilität unterstützen.

Schliesslich sollten Bilanzgruppen die Möglichkeit haben, Versorgungsrisiken grenzüberschreitend abzusichern. Übertragungsnetzbetreiber könnten sicherstellen, dass die für die Teilnahme an internationalen Kapazitätsmechanismen benötigten grenzüberschreitenden Übertragungskapazitäten langfristig gewährleistet sind. Bei Ländern ohne Kapazitätsmechanismus könnte die grenzüberschreitende Absicherung einer angemessenen Versorgung durch die Einführung von miteinander verbundenen Märkten für Absicherungskontrakte, wie zum Beispiel physisch besicherte Optionskontrakte, ermöglicht werden.

Nächste Schritte in der Konsultation

Swissgrid ist davon überzeugt, dass die hier vorgeschlagenen Massnahmen die Effizienz und die Sicherheit der Strommärkte verbessern und so deren Stabilität im Lichte der künftigen Herausforderungen erhöhen werden. Darüber hinaus werden die vorgeschlagenen Massnahmen – verbesserte Preissignale, optimierter grenzüberschreitender Handel sowie ein regionaler Ansatz für Versorgungssicherheit – neue Chancen für alle Marktteilnehmer schaffen, von Netzbetreibern bis zu Anbietern, und von Erzeugern bis zu Endkunden.

Wir freuen uns sehr darauf, diese Vorschläge mit allen relevanten Anspruchsgruppen zu diskutieren. Wir bitten Sie daher, uns bis zum 16. Februar 2016 Feedback zu unseren Konsultationsfragen zu geben. Auf Basis der Konsultationsergebnisse und der Folgeprozesse beabsichtigen wir, zeitnahe Schritte zur Umsetzung des vorgeschlagenen neuen Marktdesigns für die Energiestrategie 2050 zu ergreifen.

Um an der Konsultation mitzuwirken, verwenden Sie bitte die Ihnen zugestellten Login-Details oder senden Sie uns eine E-Mail an:
consultation.marketdesign@swissgrid.ch

Résumé du rapport

Les marchés de l'électricité européens sont en pleine mutation. Des technologies énergétiques innovantes remplacent les systèmes conventionnels, de nouveaux acteurs entrent sur le marché et la distribution et le commerce de l'électricité sont en mutation. L'Union européenne et les États membres sont en partie la source de ces changements par les réformes qu'ils mènent pour réduire leurs émissions de CO_2 et mettre en place un marché unique de l'énergie. Dans le cadre de sa Stratégie énergétique 2050, la Suisse fait face à des bouleversements comparables qui auront des implications similaires sur l'organisation du marché.

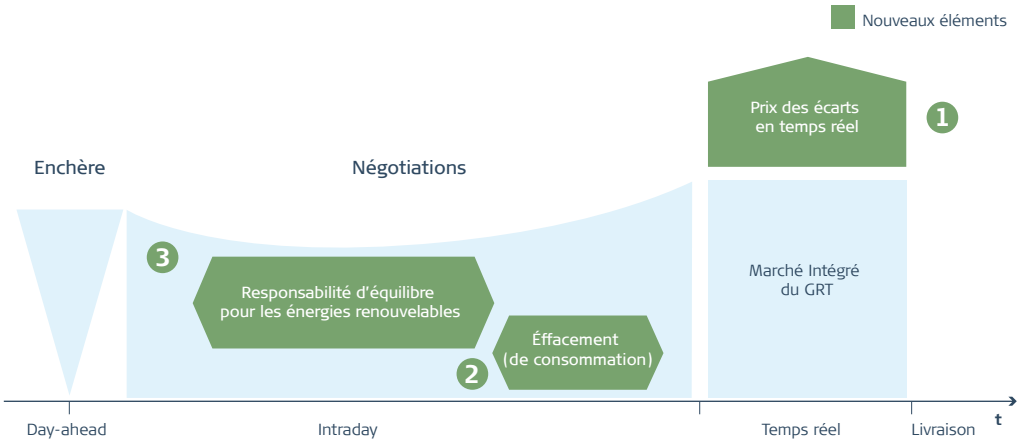
À l'issue de discussions approfondies et constructives avec de nombreuses parties prenantes, Swissgrid publie cette consultation informelle sur la réforme du marché pour tous les acteurs importants. La langue d'origine de la consultation est l'anglais afin de permettre aux partenaires européens de participer à la discussion et de décider s'ils désirent adopter ou adapter des réformes similaires. Les propositions de la consultation ont pour but d'améliorer le fonctionnement du marché suisse de l'électricité sur une période de cinq ans. La consultation est l'élément clé d'un processus décisionnel transparent qui vise à définir une démarche commune.

Dans cette consultation, Swissgrid reconnaît les mérites des principes actuels d'organisation du marché tels que la rémunération de l'électricité produite uniquement (« energy-only market »), les mécanismes de négoce efficaces et l'intégration de marchés de l'électricité en Europe. Notre objectif est de combiner et développer ces concepts dans le cadre d'une approche cohérente et durable fondée sur le marché.

Les réformes proposées se concentrent sur l'amélioration des signaux-prix, l'optimisation des échanges transfrontaliers et le développement d'une approche régionale de la sécurité de l'approvisionnement. Pour chaque thème nous proposons trois mesures concrètes qui correspondent à la responsabilité de Swissgrid de gérer les groupes-bilan et les congestions transfrontalières et d'assurer la stabilité du réseau électrique. Etant donné que le développement de propositions spécifiques pour le troisième point dépend fortement d'une plus ample coopération avec l'Union Européenne, ces propositions ne

sont actuellement présentées que de manière très conceptuelle. Les autres projets en cours dont OSTRAL, le concept de regroupement et le Marché Intégré du GRT, ne font pas l'objet de cette consultation.

Améliorer les signaux-prix



Ce graphique illustre, en bleu, la séquence des marchés pour le commerce de l'énergie, à partir de « day-ahead » jusqu'à la fourniture. La proposition, en vert, prévoit (1) l'introduction d'un nouveau régime pour calculer les prix des écarts en temps réel (2) des mesures pour permettre la participation des effacements de consommation au marché et (3) la responsabilité d'équilibre pour les énergies renouvelables.

Actuellement, les prix du marché du gros en Suisse ne représentent pas la véritable valeur des ressources du système, en particulier leur flexibilité et la garantie qu'elles apportent à l'adéquation des réseaux. Nous comprenons « flexibilité » comme la capacité d'un système à répondre aux variations soudaines de la production d'énergies renouvelables et à compenser des erreurs de prévision. Il y a plusieurs moyens d'assurer la flexibilité, une évaluation comparative permettant de déterminer la combinaison de technologies la moins coûteuse.[5] Le terme « adéquation » exprime la capacité du système électrique à répondre à la demande globale des clients finaux à tout moment, en tenant compte des arrêts planifiés, et des niveaux raisonnables d'arrêts forcés.[6]

En fin de compte, des signaux-prix inefficaces menacent la sécurité d'approvisionnement, car ils risquent d'attirer des niveaux investissement insuffisantes dans les technologies pertinentes et empêchent un développement du résau électrique basé sur le marché.. C'est la raison pour laquelle Swissgrid propose un certain nombre de mesures en vue d'améliorer l'efficacité des signaux-prix.

Tout d'abord, Swissgrid envisage d'instaurer un nouveau régime de tarification des écarts en temps réel, basé sur le Marché Intégré du GRT pour les services système à activation manuelle, comme par exemple l'énergie de réglage tertiaire ou le redispatching. Le Marché Intégré du GRT permettrait d'intégrer les différents contrats du GRT pour équilibrer le

5 Institut d'économie de l'énergie de l'Université de Cologne (2012): Options de flexibilité sur les marchés de l'électricité européens dans les scénarios de fort développement de l'électricité produite à partir de sources d'énergie renouvelables – Etude réalisée pour le compte de l'Agence Internationale de l'énergie (AIE), Cologne, 2012, p. 1.

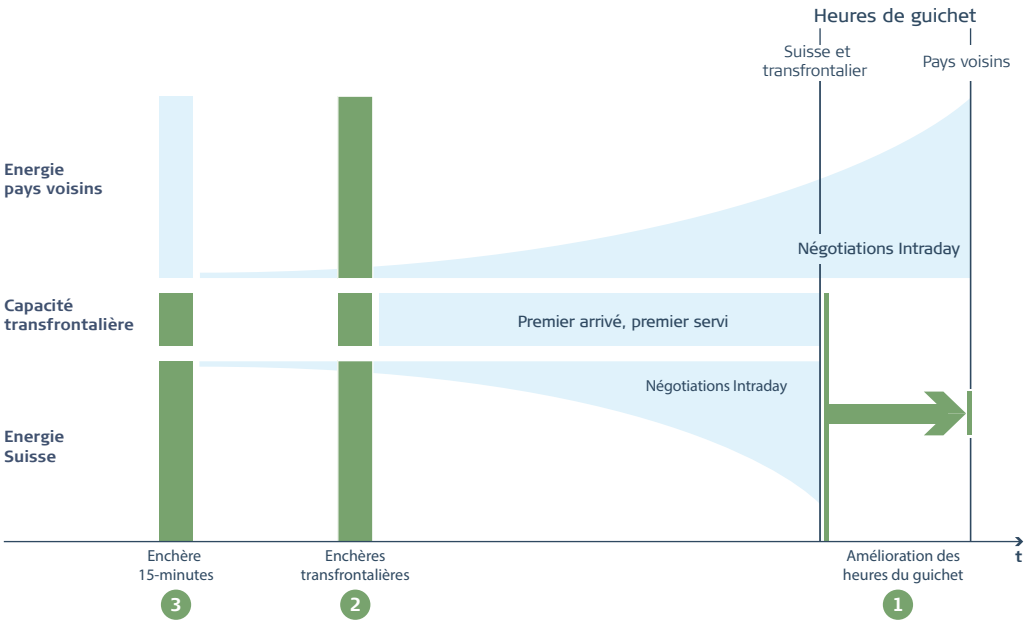
6 North American Electric Reliability Corporation (NERC) (2015): Glossaire des termes utilisés dans les normes de fiabilité de la NERC, mise à jour du 17 novembre 2015, p. 5

système et à gérer des congestions dans un seul marché. Le nouveau régime de tarification des écarts fournirait un signal de prix en temps réel qui reflèterait la pénurie réelle au sein du réseau basé sur le Marché Intégré du GRT. Pour y parvenir, les prix seraient publiés à un rythme proche du temps réel. De plus, l'introduction de prix de rareté basés sur le marché ou administratifs pourrait permettre des hausses de prix dans des situations d'équilibrage délicates, ce qui renforcerait encore le signal.

Par ailleurs, Swissgrid évalue la possibilité d'étendre le concept actuel de regroupement de plusieurs unités de production et de consommation flexibles dans une unité virtuelle de production. Un concept de ce type est déjà en œuvre sur le marché de l'équilibrage et pourrait être étendu au marché de gros. Une telle mesure pourrait, par exemple, contribuer aussi à améliorer la réactivité des effacements de consommation. Cependant, elle pourrait aussi compliquer fortement les processus de marché en Suisse. De plus, de nombreuses initiatives sont déjà en cours pour améliorer la réactivité des effacements de consommation au niveau des fournisseurs de détail et des gestionnaires de réseaux de distribution.

Pour finir, Swissgrid salue les suggestions formulées par l'Office fédéral de l'énergie afin que les nouveaux producteurs d'énergies renouvelables soient tenus d'assurer l'équilibre. Les énergies renouvelables sont actuellement subventionnées par un système de rétribution à prix coûtant de l'injection dans le réseau électrique (RPC). Les producteurs perçoivent une rémunération fixe pour chaque kilowattheure (kWh) généré, quelles que soient les conditions du marché. Les prix du marché pourraient davantage tenir compte des différentes énergies renouvelables – les énergies éolienne et solaire, par exemple – si les fournisseurs devaient respecter les productions prévues, à l'instar des producteurs conventionnels, et commercialiser leur production en commun avec d'autres sources.

Optimiser le commerce transfrontalier



Ce graphique illustre, en bleu, le volume de transactions sur les marchés intrajournaliers de l'énergie et des droits de transport transfrontaliers. La proposition prévoit (1) l'amélioration des heures de fermeture des guichets transfrontaliers, (2) la mise en place d'enchères transfrontalières en complément du système d'attribution aux «premiers arrivés» des droits de transport et (3) la participation de la Suisse et éventuellement de l'Autriche aux enchères intrajournalières allemandes des contrats de 15-minutes.

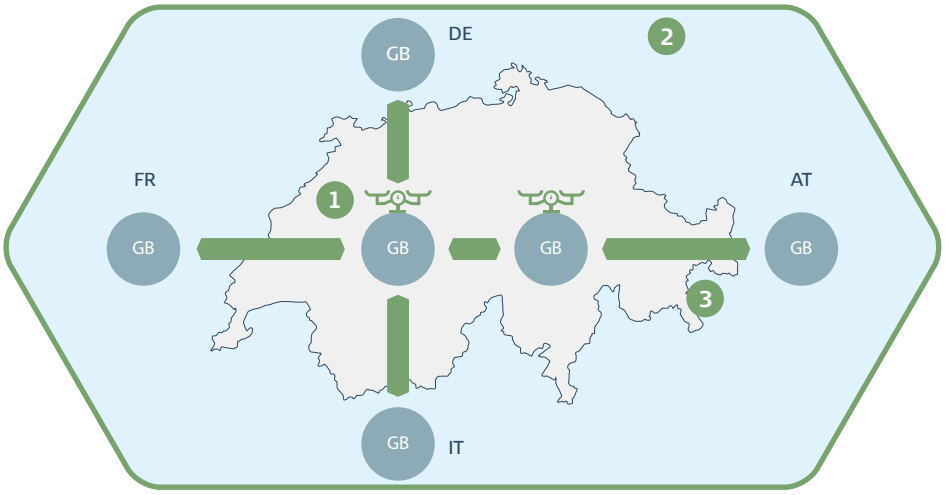
Les transformations actuellement en cours sur le réseau électrique en Europe ont d'énormes répercussions en Suisse. Le pays dispose de 40 connexions électriques transfrontalières qui totalisent une puissance d'à peu près 9 gigawatts (GW). Les flux transfrontaliers en Suisse représentent environ 10 % du total des flux transfrontaliers au sein du réseau continental européen synchronisé. Cependant, le retard accusé par les responsables politiques dans le bouclement des « négociations bilatérales » entre la Suisse et l'Union européenne isole de plus en plus la Suisse du « marché intégré de l'énergie » européen. Par conséquent, Swissgrid se concentre davantage sur des améliorations progressives et propose trois mesures spécifiques pour faciliter les transactions transfrontalières. On accorde à ces mesures une plus grande probabilité de concrétisation à court terme que le couplage du marché. Néanmoins, les relations entre l'UE et la Suisse joueront là aussi un rôle décisif.

Premièrement, Swissgrid propose de décaler les heures de fermeture des guichets transfrontaliers à ses frontières avec l'Allemagne et l'Autriche ainsi que la fermeture de guichet pour le marché national potentiellement jusqu'à 30 minutes avant le temps réel pour se conformer aux marchés intrajournaliers nationaux actuels en Allemagne et Autriche. Cette harmonisation permettrait une meilleure intégration des marchés intrajournaliers. Tous les acteurs du marché pourraient y trouver leur compte. Les marchés intrajournaliers allemand, autrichien et suisse auraient ainsi davantage de possibilités d'échanger de la flexibilité tandis que les marchés disposeraient d'un surcroît de liquidité pour les ordres à court terme. La principale difficulté pendant la mise en œuvre serait de garantir la compatibilité avec les processus et réglementations internationaux qui s'appliquent aux GRT, par exemple les codes de réseaux, qui sont largement interdépendants.

Deuxièmement, l'institution d'enchères au début de la periode de négoce pour les échanges d'énergie ainsi que les droits de transport intrajournaliers aux frontières nord de la Suisse pourrait répondre au rôle de plus en plus important que jouent les marchés intrajournaliers dans l'optimisation du réseau. Ces enchères compléteraient les échanges intrajournaliers continus d'aujourd'hui ainsi que l'exécution attendue du projet européen de plateforme d'échanges intrajournaliers transfrontaliers (XBID). Elles permettraient une allocation plus efficace des droits de transport par rapport au système actuel d'attribution aux « premiers arrivés ».

Troisièmement, une enchère intrajournalière commune de 15 minutes couvrant la Suisse, l'Allemagne et éventuellement l'Autriche, serait un moyen supplémentaire d'améliorer les échanges de flexibilité entre ces pays. Elle s'inspirerait des enchères intrajournalières actuelles en Allemagne. Introduits par la bourse EPEX SPOT en 2014, ces enchères connaissent un grand succès puisqu'elles représentent déjà plus de la moitié du volume de transactions intrajournalières allemandes sur contrats de 15 minutes.

Vers une approche régionale de la sécurité d'approvisionnement



Ce graphique représente les responsabilités des groupes-bilan (GB) en Suisse et à l'étranger pour la sécurité de l'approvisionnement. La proposition prévoit (1) le renfoncement de la responsabilité d'équilibrage en Suisse, (2) l'amélioration de la coopération régionale et européenne au niveau de la sécurité de l'approvisionnement et (3) des mesures permettant des échanges transfrontaliers d'adéquation.

Les GRT font face à des obstacles de plus en plus grands dans leur mission de sécurisation de l'approvisionnement, un marché en bon état de fonctionnement étant la condition essentielle d'une exploitation stable et en temps réel du réseau. Par contre, l'Europe a vu de plus en plus de discussions nationales sur la sécurité d'approvisionnement, qui ont mené à l'introduction de différentes mécanismes de capacité nationales. Cette mosaïque réglementaire risque de réduire l'éfficacité du marché européen intégré. C'est la raison pour laquelle Swissgrid cherche à prendre des pas vers une approche régionale de la sécurité d'approvisionnement à l'aide des trois mesures suivantes.

Premièrement, Swissgrid cherche à responsabiliser davantage les groupes-bilan en ce qui concerne l'adéquation de la production. Cette approche diffère du système plus centralisé qui attribue cette responsabilité à l'Etat ou au GRT. Responsabiliser davantage les groupes-bilan dans l'équilibrage, en les encourageant par exemple à prévenir les problèmes de liquidité ou d'adéquation du marché, améliorerait les signaux d'investissement à long terme efficaces.

Deuxièmement, Swissgrid propose de renforcer la coopération en matière de sécurité d'approvisionnement, notamment la notion d'adéquation, au niveau régional et européen. Cette coopération plus poussée serait préférable aux approches actuelles, essentiellement nationales, qui pourraient encourager une surcapacité de moyens de production. La coopération encouragerait aussi le développement d'un signal de prix plus efficace pour l'offre de flexibilité.

Pour finir, les groupes-bilan devraient avoir la possibilité de se prémunir contre les risques d'adéquation au-delà des frontières nationales. Les GRT pourraient assurer la disponibilité à long-terme de la capacité transfrontalière requis pour la participation transfrontalière aux mécanismes de capacité internationaux. Pour les pays dénués de mécanisme de capacité, la couverture transfrontalière contre les risques d'adéquation pourrait être assurée par la mise en place de marchés interconnectés de contrats de couverture, par exemple des contrats d'options adossés à des produits physiques.

Prochaines étapes de la consultation

Swissgrid est convaincue que les mesures proposées amélioreront l'efficacité et la sécurité des marchés de l'électricité et leur permettront donc de mieux surmonter les défis à venir. En outre, les mesures proposées – amélioration des signaux-prix, optimisation des échanges transfrontaliers et approche régionale de la sécurité d'approvisionnement – offriront de nouvelles opportunités à tous les acteurs du marché, des gestionnaires de réseaux aux fournisseurs, des producteurs aux clients finaux.

Nous sommes disposés à discuter ces propositions avec tous les acteurs concernés. Nous vous invitons donc à répondre au questionnaire ci-joint d'ici le 16 février 2016. En fonction des résultats de la consultation et des processus qui suivront, nous entendons prendre des mesures opportunes qui permettront de réorganiser le marché en vue de l'exécution de la Stratégie énergétique 2050.

Pour participer à la consultation, veuillez utiliser des identifiants de connexion que nous vous avons fournis ou nous envoyer un e-mail à:
consultation.marketdesign@swissgrid.ch

1. Introduction

European electricity markets are undergoing enormous changes. Innovative technologies are emerging, including new renewable energies, storage solutions and concepts such as the «smart grid» and «smart homes». These developments are expected to change dramatically the operation of electricity markets. In addition, new participants are entering the market, building innovative business cases to exploit these changes and technologies. Altogether, these shifts are increasingly impacting trading patterns and wholesale prices.

At the European Union level, member states are presently implementing reforms towards a low-carbon, single energy market. Several member states have already reformed their markets, or are in the process of doing so. Meanwhile, the European Union launched several consultations in 2015, to reach agreement on overarching governance rules and market design principles.

Switzerland is highly connected to Europe, and so is closely impacted by these reforms. It has about 40 cross-border connections with a total transmission capacity of roughly 9GW. Its cross-border flows represent around 10% of cross-border flows in the total synchronized continental European grid. Meanwhile, Switzerland is at the start of its own energy transition. The Swiss Energy Strategy 2050 foresees a phase-out of nuclear power, which presently accounts for approximately 60% of the nation's electricity production. The strategy sees a shift towards new renewable energy technologies and energy efficiency measures. Developments in Europe and Switzerland are thus largely comparable. The question is, what future electricity market design will be best for Switzerland?

To contribute to market reforms, Swissgrid has participated for many years in the energy policy debate in Switzerland and Europe. Swissgrid has published several contributions, for example under the themes of «Flexibility Markets» and «Markets for Flexibility and Adequacy». These contributions have highlighted the principles of competition, investment incentives and integration of European electricity markets. Swissgrid has explored the feasibility of its ideas using various platforms and through intense co-operation. And it has complemented its analysis with innovative and promising approaches from within Europe.

Swissgrid has published this informal consultation for all relevant stakeholders, for a transparent and constructive decision-making process. It is written in English, to allow European partners to participate in the discussion, and to take note of, adopt or adapt

the proposals for themselves, where they see fit. Swissgrid proposes measures to improve the design of the Swiss electricity market over the next five years. Swissgrid is also open to further ideas and alternative proposals, and has therefore integrated a number of consultation questions in the final section of each chapter of the document. It invites feedback before February 16th 2016. A summary of consultation questions as well as the process for submitting responses is given in chapter 5.2.

1.1. The responsibility of Swissgrid in market design

For the purposes of this paper, market design is defined as the process for creating the interaction of laws and rules under which electricity generators, traders, energy-intensive industry and electricity distributors, in particular, conduct their business.[7] Ideally, such market design will create performance incentives for individual market participants that fosters behaviour in line with overall political energy targets and underlying economics.[8]

The Electricity Supply Act (StromVG) and Electricity Supply Ordinance (StromVV) lay out the legal framework and guidelines for power transmission, and define Swissgrid's mandate and the basic conditions for its business activities. Swissgrid performs its services for the public, and in that regard has a clear mandate from the Swiss Federal Government. It operates in the context of a regulated electricity market under the oversight of the Swiss Federal Electricity Commission (ElCom).[9]

The Swiss Electricity Supply Act mandates Swissgrid to enhance market design, for example through the adaptation of conduct rules for electricity market participants:

» Swissgrid is responsible for the operation of balancing group management and provides system services including balancing energy. The required generation capacities are procured using transparent and non-discriminatory procedures.[10]
» Swissgrid is responsible for cross border congestion management, using market-oriented procedures such as auctions.[11]
» Swissgrid is responsible for a permanently non-discriminatory, reliable and efficient operation of the transmission grid, to guarantee a reliable power supply for Switzerland.[12]

In relation to Swissgrid, the Swiss Federal Electricity Commission can be considered a so-called «ex-post» regulator. It does not actively conduct market design, but monitors the implications of new design proposals and their compliance with tariff- and network-related objectives. In comparison with transmission system operators in other European countries, this ex-post model of market regulation leads to a more active market design role and wider responsibilities for Swissgrid.

7 Ockenfels A. (2015) Marktdesign. In: Gablers Wirtschaftslexikon. Marktdesign, Springer Gabler Verlag (Ed.), Berlin 2015. Available online at: http://wirtschaftslexikon.gabler.de/Archiv/17927/marktdesign-v7.html
8 Kühnke A. (2013) Neues Systemverständnis & Erneuerbare Energien. Kernthema Strommarktdesign. ZVEI - Zentralverband Elektrotechnik- und Elektronikindustrie, Frankfurt, Mai 3, 2013, Seite 1. Available online at: http://www.zvei.org/Downloads/Energiewende/Strommarktdesign-Strommarkt-ZVEI-S23.pdf
9 See role definitions for the National Grid Company and ElCom according to Art. 18 – 23 StromVG.
10 Art. 20 (2) (b) StromVG
11 Art. 17 (1) StromVG
12 Art. 20 (1) StromVG

1.2. Swiss and European electricity market design challenges

We observe that the electricity system in all its dimensions is being impacted by fundamental changes in the energy mix. The establishment of network codes and guidelines is now progressing to deliver the European Target Model for electricity markets. Meanwhile, discussion on further market design reform has picked up speed across Europe. Discussions are ongoing in many countries, and the first market reforms have already been implemented:

» Great Britain has held its first capacity auction for delivery starting 2018/19, and France is close to launching its own capacity market. Meanwhile, Italy and Ireland are in advanced design stages for capacity markets based on physical options.

» German stakeholders are intensively discussing alternative arrangements. The federal government has set out new, power market design proposals, including a network reserve and a climate/capacity reserve, in its «Green and White Paper»[13] and the new draft of the «Strommarktgesetz».

» At the European level, efforts are ongoing to ensure further integration of energy markets, while seeking to limit the impact that national capacity markets have on pan-European trading arrangements. The latter focus on energy-only price as the determinant of energy flows. Examples of efforts to reconcile the two include the Energy Union,[14] revised State Aid guidelines for capacity mechanisms, and ongoing, European Commission consultation on energy market reforms, which is expected to lead to further legislation in 2016.[15]

While some European countries are establishing capacity mechanism regimes to guarantee security of supply, responding to a changing energy mix, the situation in Switzerland is different. Due to its high volume of hydropower generation, it has surplus flexible generation which can help other European countries balance supply and demand in real time. Therefore, Switzerland is a potential flexibility provider for the European power system, and Swiss generation can support system balancing and perhaps participate in the national capacity mechanisms of neighbouring countries.

Nevertheless, developments in Europe and Switzerland are largely comparable. Switzerland has decided its nuclear phase-out, and one of the targets of its Energy Strategy 2050 is to switch to an almost entirely renewable electricity production. Furthermore, Switzerland is highly interconnected with European member states, with about 40 cross-border transmission lines totalling about 9 gigawatts (GW) capacity. That compares with peak Swiss demand of up to 10.5 GW.[16] Its cross-border flows represent around 10% of the cross-border flow in the total synchronized European continental grid.

Swiss electricity market design reform faces three main challenges, summarized as follows:

13 Federal Ministry for Economic Affairs and Energy (2014) An Electricity Market for Germany's Energy Transition. Discussion Paper of the Federal Ministry for Economic Affairs and Energy (Green Paper), Berlin, October 2014. Available online at: https://www.bmwi.de/BMWi/Redaktion/PDF/G/gruenbuch-gesamt-englisch,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

14 European Commission (2015) A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy. COM (2015) 80, Brussels, February 25, 2015. Available online at: http://ec.europa.eu/priorities/energy-union/docs/energyunion_en.pdf

15 European Commission (2015) Public Consultation on a New Energy Market Design. Communication from the Commission of the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Final Version. Brussels, July 15, 2015.

16 Bundesamt für Energie (2015) Schweizerische Elektrizitätsstatistik 2014. Bern 2014, p. 33.

1. **Adapting the market design to allow renewable integration**
   Non-market-based incentives for the affordable deployment of new renewable energy sources (RES) are in place in many European countries. At the same time, electricity systems have become increasingly interdependent. Due to these non-market-based incentives, plus the frequency of operation of renewable energy, many European electricity markets are currently in a transition period towards a system where thermal plants must operate less, but with more flexibility, according to when they are needed.[17] Therefore, Swissgrid implicitly works with the assumption that an increasingly decentralized market design with self-dispatch components will develop. In turn, this requires improvements in terms of balancing incentives and also balancing responsibilities for RES, with fully cost reflective balancing prices which reward flexible generation capacity and the demand side, for the new role that they must play. This trend is expected to continue in the years ahead.[18]

2. **Regional co-operation and coordination of energy policies**
   The development of diverging national energy policies will limit the opportunity to achieve the full economic benefit of an interlinked European electricity system. Current market design discussions follow different national approaches, to ensure generation adequacy and other national policy objectives. For example, Britain, France and Italy are implementing capacity markets with various designs, while Germany has opted against a comprehensive capacity market, preferring a strategic reserve, which it calls a climate and capacity reserve.[19] Such proposals and approaches have arisen from a debate about whether energy-only-markets can provide sufficient long-term investment incentives.[20]

   The Swiss regulatory framework presently does not foresee capacity markets. Swissgrid has noted that most Swiss stakeholders view capacity markets with increasing scepticism. Ultimately, most capacity markets act to supplement the energy price, reducing the volatility of the residual energy price and legitimising the existence of 'missing money' in the traded energy market. They replace market risk with regulatory risk. Commentators say that in an isolated market, effective incentives could still exist with separate capacity and energy markets, but the success of European market coupling arrangements require the spot price to reflect the full value of electricity, not just a part of it.

3. **A European security of supply perspective**
   A European security of supply perspective requires coordinated solutions to transnational problems. As a minimum, it is necessary to focus on the development of regional adequacy measures that guarantee security of supply in Europe, despite the increasing generation of intermittent renewables and the shutdown of conventional power plants.[21]

17 By definition, flexibility is the capability to balance rapid changes in renewable generation and forecast errors within a power system. Several options are available to provide flexibility and need to be comparatively evaluated to determine the cost-efficient mix of technologies. See: Institute of Energy Economics (EWI) (2012) Flexibility Options in European Electricity Markets in High RES-E Scenarios. Study on behalf of the International Energy Agency (IEA), University of Cologne, Final Report, October 2012, p. 1. Available online at: http://www.ewi.uni-koeln.de/fileadmin/user_upload/Publikationen/Studien/Politik_und_Gesellschaft/2012/Flexibility_options_in_the_European_electricity_markets.pdf

18 Bössner S. (2015) Strengthening the European Electricity Market Through Improved Franco-German Co-operation. Policy Paper 127/p.1, Jacques Delors Institute. Paris/Berlin, March 15, 2015.

19 Negative evaluations regarding the potential implementation of capacity markets are e.g. published in: European Engine Power Plants Association (EUGINE) (2014) Position Paper: Recommendations to meet the 'Flexibility Challenge'. Brussels, December 8, 2014, p. 1; The Regulatory Assistance Project (RAP) (2014) Power Market Operations and System Reliability. A Contribution to the Market Design Debate in the Pentalateral Energy Forum. Study on behalf of Agora Energiewende. Berlin, December 2014, p. 9.

20 Joskow P. (2008) Capacity Payments in Imperfect Electricity Markets: Need and Design. Utilities Policy 16 (3), 2008.

21 «The term adequacy expresses the ability of the electric system to supply the aggregate electrical demand and energy requirements of the end-use customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements». See: North American Electric Reliability Corporation (NERC) (2015) Glossary of Terms Used in NERC Reliability Standards. Updated December 3, 2015, p. 5. Available online at: http://www.nerc.com/pa/stand/glossary%20of%20terms/glossary_of_terms.pdf

Potential solutions should be implemented in an «energy-only» market design framework which ensures that market coupling arrangements work effectively through spot prices which reflect the full value of electricity. This avoids increasingly prescriptive regulations targeted at ensuring resource adequacy. It would also change the nature of the remaining challenges, and allow for market-based approaches that do not overrule the market.[22]

A further challenge of the present energy-only market, that should not be underestimated, concerns the gap between the economic energy trading patterns and the resulting physical flows through the energy network. On the physical side, this is re-enforced by events such as the numerous causes can be identified, including shut-down of conventional generation, ambitious installation plans for renewables as well as delayed grid enforcement. As a result, it has become increasingly difficult to guarantee a resilient network on a national and European scale.

Several aspects of this potential solutions to this challenge, such as the responsibility of balance groups in combination with scarcity prices are adressed in this document, while others, such as redispatch possibilities and finally grid enforcements where possible are less in the scope of the present wholesale market design consultation.

22 Hogan W. (2005) On an «Energy Only» Electricity Market Design for Resource Adequacy. Center for Business and Government, John F. Kennedy School of Government, Harvard University. Cambridge, Massachusetts. September 23, 2005.

1.3. Scope of the consultation

Existing regulation of the interaction between the wholesale market and balancing group management, as well of cross-border congestion management, was originally defined before 2009. It does not therefore necessarily address all aspects of the new challenges arising from the energy transition, as well as the other trends listed above.

» The balance group management (BGM) which defines important processes for wholesale market interactions was established by Swissgrid in 2009, based on the legal assignment according to article 20 of the Energy Supply Act (StromVG). Only minor adaptions have been carried out since the BGM establishment, although the electricity market was and is subject to a constant evolution.

» A similar situation has prevailed for cross-border congestion management, where Swissgrid has largely focused on adhering to European standards.[23]

Swissgrid therefore decided to focus on these topics in 2014, in close co-operation with market participants. The aim was for a strategic adaption of the electricity wholesale market to current and future challenges. The present report makes design proposals based on discussions with market participants.

Ongoing initiatives beyond the scope of this consultation

Swissgrid is already active in several additional initiatives, with similar goals to improve wholesale market design. As these projects are ongoing, with active stakeholder participation, they are not dealt with in this document. These ongoing initiatives are principally OSTRAL, the Pooling Concept and the Integrated TSO Market, briefly summarized below.

OSTRAL

The market reforms proposed in the present document apply at times of «regular» electricity system operation. OSTRAL is the organization responsible for electricity supply in exceptional situations, such as «severe shortages», under article 102 of the Swiss Federal Constitution. The Federal Office for National Economic Supply is responsible for declaring an exceptional situation, which in turn activates OSTRAL measures.

The Federal Government is responsible for the preparation and conduct of measures to maintain the supply of Switzerland with vitally important goods, including electricity. The Federal Government has requested the Association of Swiss Electricity Companies (VSE) to investigate the necessary preparations to handle a severe power shortage.[24] Swissgrid is closely co-operating with and supporting the VSE industry association, to define viable and efficient OSTRAL procedures. This important industry co-operation will lead to even better emergency system management from a security of supply perspective.

Pooling concept

In 2013, Swissgrid and the VSE industry association published a document on control energy pooling, to enable ancillary services to be provided by any balance group. Swissgrid introduced two key changes. First, technical systems at Grid Levels 5 (the regional distribution grid) and 7 (the local distribution grid) can now be grouped into virtual

23 This includes the implementation of cross-border auctions, continuous intraday trading and the technical readiness for Market Coupling. See also chapter 3.

24 Schweizerischer Bundesrat (2013) Verordnung über die Vollzugsorganisation der wirtschaftlichen Landesversorgung im Bereiche der Elektrizitätswirtschaft (VOEW). Dezember 10, 2010 (Stand am Januar 1, 2013).

generating units for supplying control energy. All sizes and types of technical systems can be included in virtual generating units. Second, technical systems can be integrated into balance-group-neutral control energy portfolios across Switzerland, regardless of their balance group affiliation.[25]

These changes enable players in the ancillary service market to consolidate their generating and consumption units. The changes will also open up the market to new providers. The new approach has proven to be solid and innovative. Its complexity, however, was a challenge for Swissgrid and industry representatives. This ambitious project came to successful conclusion in September 2013 with the signing of revised balance group and AS contracts with all Swissgrid partners. It reflects major progress in the ancillary service segment of the electricity industry. The pooling concept will be reviewed in 2016 in coordination with VSE.

Integrated TSO Market

The Integrated TSO Market concept intends to achieve optimal deployment of manually activated ancillary service products, for a secure and balanced operation of the transmission network. The aim is to overcome drawbacks in current deployment settings. The focus of the market is manually, dispatcher-activated frequency restoration as well as re-dispatch products. Related products are currently activated for different operational goals, while they have common technical characteristics. For example, the activation of tertiary reserves is quite frequent in the Swiss control area, but does not consider network constraints. As a result, congestions can arise after the deployment of such reserves. On the other hand, redispatch activation is not so frequent in the Swiss control area, and generating units are paid based on indexed prices.

The proposed design optimally combines the positive characteristics of these products, and provides a new trading opportunity for market participants. The market clearing price is based on the optimization of the actual costs for balancing, redispatch, or both, subject to network constraints. The Integrated TSO Market foresees a «pay-as-cleared» remuneration principle for activated energy, given perceived advantages in applying marginal pricing.

Swissgrid is already discussing the Integrated TSO Market concept with industry representatives in a dedicated working group. Therefore, the description of the detailed timing, rules, processes and procedures of its implementation is not part of this consultation.

Consultation questions on chapter 1

Q 1: Do stakeholders consider the main market design topics addressed by Swissgrid to be appropriate?

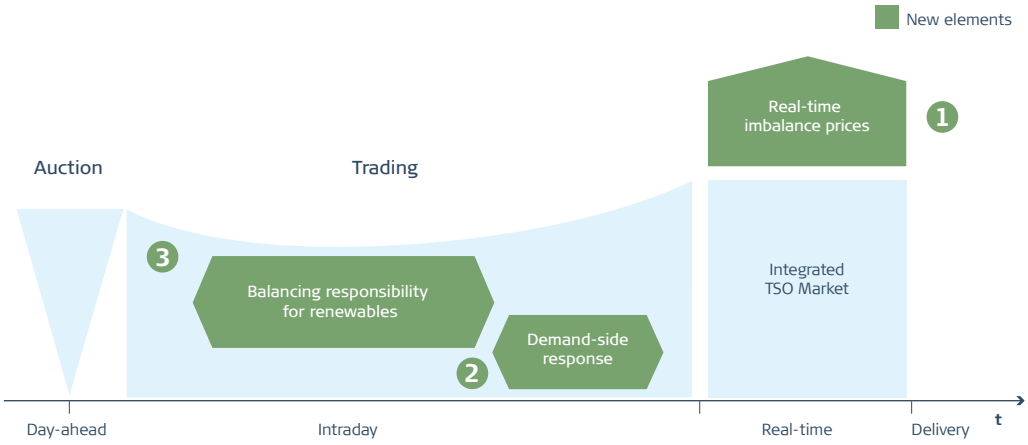
Q 2: Are the stakeholders of the opinion that Swissgrid should address additional market design topics besides the three main topic areas of the consultation?

25 Verband Schweizerischer Elektrizitätsunternehmen (VSE) (2013a) Branchenempfehlung Strommarkt Schweiz – Anbindung von Regelpools an den Schweizer SDL-Markt. Aarau, Oktober 2013; Verband Schweizerischer Elektrizitätsunternehmen (VSE) (2013b) Branchenempfehlung Strommarkt Schweiz – Standardisierter Datenaustausch für den Strommarkt Schweiz. Anhang Z2 – Regelungen zum Umgang mit bilanzgruppenfremden SDL-Anbietern im Schweizer SDL-Markt. Aarau, Juli 2013.

2. Improve the price signal

In the Swiss wholesale market, prices close to real time and in particular imbalance prices do not fully represent the true value of flexibility. This increasingly leads to sub-optimal trading incentives, as well as weakened investment signals. To address this situation, Swissgrid has conducted a number of studies, alongside Swisselectric and Pöyry,[26] as well as with an industry stakeholder group. As a result of these studies, Swissgrid is proposing the measures outlined below, and will be partially responsible for their implementation.

Figure 1: Proposed measures to strengthen the price signal



Source: Swissgrid

26 Swissgrid (2015) Machbarkeitsstudie für die grenzüberschreitende Vermarktung von Flexibilität. Oktober 1, 2015. Available online at: https://www.swissgrid.ch/swissgrid/de/home/current/news/_01_10_2015_01.html

1. **Implement real-time imbalance prices** – Swissgrid proposes an imbalance price regime with a single price, published closer to delivery, based on a newly designed, Integrated TSO Market. This regime could provide a real-time, imbalance price signal which reflects actual scarcity in the system. The price signal could be further strengthened through marginal pricing of imbalances at the value of lost load during curtailments. In addition, an administrative scarcity pricing function could raise imbalance prices in situations where there is a growing risk of curtailments.
2. **Enable demand-side response (DSR)** – Swissgrid is studying whether the present DSR pooling model operated in the TSO market should be expanded to the wholesale market. While such a measure could provide an additional driver for the introduction of DRS, it would have a potentially large and complicating impact on Swiss market processes. In addition, numerous DSR initiatives are already underway at the retail- and Distribution System Operator (DSO)-level.
3. **Introduce balancing responsibility for renewables** – Swissgrid welcomes suggestions by the Swiss Energy Office to move towards balancing responsibility for new, intermittent renewable energy. Today, renewables are subsidized through cost-covering remuneration for feed-in to the electricity grid (CRF). They receive a fixed remuneration for each kWh they produce, independent of market conditions. Market prices could better account for new renewables when their production is marketed jointly with other sources, where suppliers have to meet their forecast output.

These measures are described in more detail in sections 2.1 to 2.3.

2.1. Implement real-time imbalance prices

Imbalance prices are at present systematically different from marginal real-time prices, and are published more than one month after the delivery period. Under the current system, these imbalance charges are derived from the following reference prices, for each 15-minute settlement period:

» PSpot = the marginal clearing price for the 15-minute period in the day-ahead auction
» PSec = the highest activated secondary regulation energy price for the 15-minute period
» PTer = the highest activated tertiary regulation energy price for the 15-minute period

Imbalance charges also depend on the direction of the imbalance, and are calculated as follows:

» For each MWh of underproduction, balance groups pay:
PShort = 1.1*[Max(PSpot, PSec, PTer) + 1ct/kWh]
» For each MWh of overproduction, balance groups are paid:
PLong = 0.9*[Min(PSpot, PSec, PTer) – 0.5ct/kWh]

Revenues for imbalances which help the system are thus systematically different from the avoided system balancing cost. Furthermore, there is no information about the level of total system imbalance close to real time. And the secondary control energy price PSec is only known well after delivery, because it is indexed to the weekly Swissix Base price. Other price components, such as PTer, are only known by the owners of the plants that were activated.

This present situation leads to several challenges. As intraday markets are very illiquid, market participants have insufficient information to optimize their intraday dispatch decisions. And as imbalance prices can be expected to be below the intraday price levels in several situations, market participants may have an incentive to arbitrage between intraday markets and imbalance settlement. Taking such deliberate imbalance positions poses a risk to the Swiss balancing system. In addition, the present regime may disadvantage smaller market players that do not have a portfolio of plants offering tertiary balancing energy, as they will have less visibility over prices.

To resolve these challenges, imbalance prices should be based on real-time prices, and published close to real time. In particular, this would mean a move towards:

» **Reference to the real-time market:** once the Integrated TSO Market is active (see section 2.1), the resulting real-time prices could be used as a reference for imbalance prices which would eliminate arbitraging incentives between the Integrated TSO Market and imbalance prices.
» **Earlier publication of imbalance prices:** imbalance prices are currently published more than one month after delivery. Earlier publication, no more than one hour after delivery, could benefit market participants by allowing them to react to rising imbalance prices. It would also help reduce the information deficit for smaller market players.
» **Earlier publication of imbalance volumes:** imbalance prices are strongly dependent on the volume and direction of system imbalances, which are currently not published close to real-time. Prompter publication of the level of system imbalance volume, no more than one hour after delivery, could help smaller market players, in particular, to optimize their dispatch.

» **Single imbalance prices:** positive and negative imbalances could be settled at the same price. This would create a more transparent and efficient price signal. It remains to be seen, however, whether this concept creates a sufficient balancing incentive for balance groups.

The above proposals are very similar to those adopted in Great Britain and the Netherlands. In April 2015, Britain's Ofgem adopted reform proposal P305[27] for balancing arrangements, which included more marginal imbalance prices and single imbalance prices.

To ensure marginal pricing which reflects the true cost of curtailments, imbalance prices could be raised to the value of lost load, in the unlikely event of adequacy shortcomings and a subsequent market suspension.

In addition, some regions and countries such as Texas[28] and Great Britain[29] have introduced an administrative scarcity pricing function, which increases the imbalance cost before the occurrence of an actual outage, whenever operating reserve margins are reduced below a critical level. The intention here is to ensure that the cost of growing outage risk is reflected in market prices.

Such an approach ensures that the market does not have to wait for actual curtailments to raise price high enough to attract investment. However, these administrative scarcity prices could be interpreted as capacity payments, and would need to be aligned with price signals in the Integrated TSO Market, as well as other balancing incentives, to prevent undue arbitraging opportunities. Scarcity prices could also increase the risk of market power abuses, however this could be mitigated through markets for option contracts (see chapter 4.3).

27 Ofgem (2014) Electricity Balancing Significant Code Review – Final Policy Decision. London, May 15, 2014. Available online at: https://www.ofgem.gov.uk/sites/default/files/docs/2014/05/electricity_balancing_significant_code_review_-_final_policy_decision.pdf
28 Potomac Economics (2015) 2014 State of the Market Report for the ERCOT Wholesale Electricity Markets. Potomac Economics Ltd, July 2015. Available online at: https://www.potomaceconomics.com/uploads/ercot_documents/2014_ERCOT_State_of_the_Market_Report.pdf
29 Ofgem (2014) Electricity Balancing Significant Code Review – Final Policy Decision. London, May 15, 2014. Available online at: https://www.ofgem.gov.uk/sites/default/files/docs/2014/05/electricity_balancing_significant_code_review_-_final_policy_decision.pdf

2.2. Enable demand-side response

The use of the demand side is generally referred to as Demand-side Response or Demand-side Management. In the present report, we define these terms as follows: Demand-side Response (DSR) is load demand that can be actively changed by a trigger. Demand-side Management (DSM) is the utilization of DSR for a purpose such as system security, for example in balancing and congestion, or system adequacy.[30]

While basic applications of DSM have been used for many decades in Switzerland, several more sophisticated initiatives have emerged in Switzerland in recent years. For example, close co-operation between Swissgrid and the VSE industry association led to the introduction of a market role for an independent reserve pool provider.[31] This gives balancing responsible parties the opportunity to aggregate the DSR-potential of their own consumers and clients of other balance groups, and to offer it in the Swissgrid reserve market. Swissgrid observes that this opportunity to provide secondary and tertiary balancing energy is increasingly used by market parties. In addition, there are a number of pilot projects and initiatives underway to apply DSR aggregation and utilization at the retail and DSO level.[32]

In the light of the present abundant supply of flexible generation, by hydropower generation, and only a moderate demand for flexibility in Switzerland and Europe, the business case for DSM in the short-term seems limited.[33] From this perspective, existing applications and initiatives may be sufficient.

Nevertheless, the future change to more significantly stochastic generation, expected under the Swiss Energy Strategy 2050, may require a greater role for DSR. Future demand for flexibility in neighboring countries is also expected to rise. In the long-term, therefore, the potential for DSR and related business models in Switzerland might grow significantly. This expectation is supported by studies that evaluate the future technical potential of DSR in Switzerland. Table 1 shows forecasts for a technical load shifting potential of approximately 5 TWh in the year 2020, and up to 12 TWh in the year 2050.

30 ENTSO-E (2014a) Demand Side Response Policy Paper. Brussels, September 15, 2014, p. 1. Available online at: https://www.entsoe.eu/Documents/Publications/Position%20papers%20and%20reports/140915_DSR_Policy_web.pdf

31 For more information, please refer to the description of the pooling concept in section 1.3 of this document.

32 See e.g.: Swiss Economics and Ecofys (2015) Zukünftige Energiemärkte und die Rolle der Netzbetreiber. Abschlussbericht im Auftrag des BfE, Bern, März 16, 2015. Available online at: http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=de&name=de_690889572.pdf; Consentec (2015) Koordination von Markt und Netz – Ausgestaltung der Schnittstelle. Untersuchung im Auftrag des Bundesamt für Energie. Abschlussbericht, Bern, Juli 9, 2015.

33 This observation of a limited commercialization of DSM business models is also linked to the fact that currently in Europe «less than 4 percent of the available demand is utilized to provide DSR». See: European Commission (2013) Incorporating Demand Side Flexibility, in Particular Demand Response, in Electricity Markets. Commission Staff Working Document SWD (2013) 442 final, Brussels, November 5, 2013. Available online at: https://ec.europa.eu/energy/sites/ener/files/documents/com_2013_public_intervention_swd07_en.pdf

Table 1: Technical potential for load shifting in Switzerland according in the WWB («weiter wie bisher» = «business as usual» and NEP («Neue Energiepolitik» = «New Energy Policy») Scenarios.

	2020		2025		2035		2050	
Total electricity consumption (TWh)	WWB	NEP	WWB	NEP	WWB	NEP	WWB	NEP
Residential	17.94	17.75	17.86	17.03	17.72	15.53	17.81	13.56
Industrial and services	40.36	36.78	40.83	34.56	41.92	31.47	45.00	28.50
Transport	0.08	0.40	0.33	1.17	1.12	3.26	3.84	9.08
of which shiftable (TWh)								
Residential	0.67	3.32	0.97	6.15	1.50	5.71	2.33	3.77
Industrial and services	0.31	1.52	0.46	2.85	0.74	2.90	1.28	2.76
Transport	0.004	0.11	0.03	0.63	0.16	2.04	0.98	6.14
of which shiftable (%)								
Residential	3.73	18.72	5.43	36.11	8.48	39.82	13.06	27.79
Industrial and services	0.77	4.13	1.13	8.26	1.77	9.22	2.84	9.67
Transport	5.09	26.43	8.18	54.04	14.25	62.36	25.57	67.60
of which shiftable (%) in case of full smart-meter roll-out								
Residential	46.85	46.79	45.26	45.14	42.42	40.91	37.32	29.25
Industrial and services	9.67	10.33	9.42	10.33	8.86	10.25	8.12	10.18
Transport	63.68	66.07	68.15	67.56	71.25	69.29	73.05	71.16

Source: E. Thoma (2015): «Demand Side Management: Potential and impact on the Swiss transmission grid»

Improve the framework for demand-side response

Such significant figures raise the question what kind of market reforms in Switzerland in the mid-term could integrate the demand-side, and treat this as another market participant, on equal and transparent terms with generation and storage.[34]

To answer this question, it is necessary to understand the barriers that currently prevent the full market integration of the demand-side. A study conducted by Swissgrid and other market parties made the surprising finding that there were no central technological barriers to DSM utilization. Instead, the study found a combination of regulatory and market barriers. First, regulatory examples show that, there are no tariff-related incentives, creating a conflicting interest with established ripple steering technologies, and no regulatory support for the roll-out of smart meters. Second, there are market-related challenges. These market challenges include: poor transparency over real-time demand for flexibility; missing price signals; and a missing market opportunity for active trading. These problems reflect how flexibility presently has a very limited financial value, under the present market design.[35]

Based on these summarized shortcomings, table 2 identifies requirements for an efficient utilization of demand-side potential.[36]

34 Cambridge Economic Policy Associates Ltd, TPA Solutions & Imperial College London (2014) Demand Side Flexibility – The Potential Benefits and State of Play in the European Union. Final Report for ACER. Cambridge/UK, September 29, 2014. Available online at: http://www.acer.europa.eu/official_documents/acts_of_the_agency/references/dsf_final_report.pdf

35 Enadvice (2016) Multi-Client Studie Endkundenflexibilität – Eine Empfehlung zur besseren Nutzung der Flexibilitätspotentiale bei den Schweizer Stromverbrauchern bis 2020. Preliminary Version, Zürich, Dezember 2015, p. 40.

36 Enadvice (2016) Multi-Client Studie Endkundenflexibilität – Eine Empfehlung zur besseren Nutzung der Flexibilitätspotentiale bei den Schweizer Stromverbrauchern bis 2020. Preliminary Version, Zürich, Dezember 2015.

Table 2: Required improvements in different categories in order to optimize the utilization of end customer flexibility[37];

Transparency	
1	Set-up of a platform for electricity market data
2	Creation of transparency regarding the ripple control utilization
3	Implementation of standards for the utilization of end customer flexibility
Market efficiency	
4	Market design adjustment in order to reflect the «true» value of flexibility
5	Adjustment of end user tariffs in order to create incentives for the marketing of flexibility
6	Implementation of the «grid optimization before grid expansion» principle on all grid levels
7	Opening and liberalization of the market for metering services
Non-discriminatory market participation	
8	Opening and development of markets for the utilization of end customer flexibility
9	Definition of rules and processes for the utilization of end customer flexibility
10	Evaluation of expanding the existing pooling concept
Support	
11	Integration of micro combined heat and power generation into the Swiss Energy Strategy 2050
12	Equal treatment of end customer flexibility in the electricity market

Source: Enadvice (2016): Multi-Client Studie Endkundenflexibilität – Eine Empfehlung zur besseren Nutzung der Flexibilitätspotentiale bei den Schweizer Stromverbrauchern bis 2020, Zürich, Dezember 2015 (preliminary version)

Evaluate an independent aggregator role in the wholesale market

Swissgrid does not consider itself to be in a lead role to implement the market refinements identified in table 2. For the most part, they either refer to the distribution system operator/generator interface, or else require political decisions.

In this context, Swissgrid values very highly analysis undertaken on behalf of the Swiss Federal Office of Energy, in co-operation with distribution system operators, regarding potential design options for the market and grid interface.[38] In particular, Swissgrid considers a so called «traffic light model» for the grid status at the distribution level to be an innovative approach that merits further evaluation. In this model, the right of third parties to activate flexibility potential, including demand-side service providers and aggregators, depends on the actual grid status. A green light allows the conduct of demand-side related service operations by third parties, while a red light indicates a critical grid situation, which blocks these activities.

However, Swissgrid also has a role to play. In co-operation with market parties, Swissgrid should evaluate the non-discriminatory market participation of the demand-side, based on an expansion of the existing pooling concept (requirement number 10 in table 2

37 For a detailed explanation of the required improvements mentioned below please refer to: Enadvice (2016) Multi-Client Studie Endkundenflexibilität – Eine Empfehlung zur besseren Nutzung der Flexibilitätspotentiale bei den Schweizer Stromverbrauchern bis 2020. Preliminary Version, Zürich, Dezember 2015, p. 44-46.

38 Consentec (2015) Koordination von Markt und Netz – Ausgestaltung der Schnittstelle. Untersuchung im Auftrag des Bundesamt für Energie. Abschlussbericht, Bern, Juli 9, 2015; Swiss Economics and Ecofys (2015) Zukünftige Energiemärkte und die Rolle der Netzbetreiber. Abschlussbericht im Auftrag des BfE, Bern, März 16, 2015. Available online at: http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=de&name=de_690889572.pdf

above). This should include a verification of the compliance with StromVG of an independent aggregator model outside of ancillary service markets. European countries such as France and the United Kingdom have started to introduce reforms along the lines of expanding existing pooling concepts. These reforms are especially related to the access of independent aggregators to wholesale electricity markets.[39]

In addition, Swissgrid should evaluate the prioritization of end customer flexibility on the electricity market (requirement 12 in the table above). Swissgrid and Swiss energy industry participants have jointly identified hurdles for requirement 12, and defined general requirements for an optimized utilization of end customer flexibility on the Swiss electricity market.[40]

Meanwhile, Swissgrid will continue its efforts to develop an efficient framework for the market integration of end customer flexibility, by evaluating specific measures based on the requirements in table 2. Independent aggregators might be required, since the majority of consumers have neither the infrastructure in place nor the knowledge required to sell their demand-side flexibility directly. They need help from an aggregation service provider. This role could either be taken by electricity suppliers, which possess the knowledge and expertise to bring flexibility to the market, as an integrated provider, or by independent aggregators. Independent aggregators would neither sell electricity nor have the role and function of a balance group, and would thus represent a new role within European electricity markets. Another possibility consists of independent aggregators offering their services to electricity suppliers and partnering with them.[41]

Swissgrid is thus studying whether an independent aggregator role should be introduced, based on experience gained with the present reserve pooling concept. Such analysis would include an evaluation of whether such procedures could be adjusted appropriately, and transferred to the day-ahead and intraday markets. At present, there is neither a neutral third party triggering the activation of a DR event, nor a clear balancing group correction mechanism in place.

Swissgrid is currently considering the advantages and challenges regarding the introduction of a new role for an independent aggregator, into the market design. On the one hand, an expansion of the pooling concept, with an aggregator role, could provide an additional driver for the introduction of DSR. Innovative business models would most likely develop and compete, to capitalize on the establishment of portfolios of aggregated demand flexibility. On the other hand, expanding the pooling concept to wholesale markets could have a potentially large and complicating impact on Swiss market processes. First, it would impact communication flows with close to 730 Swiss DSOs. Second, the integration of an independent aggregator role into the market design would require data exchange systems which guarantee that BRPs would not have to cover any additional cost due to a demand response event that was triggered by an independent aggregator.

39 Consentec (2015) Koordination von Markt und Netz – Ausgestaltung der Schnittstelle. Untersuchung im Auftrag des Bundesamt für Energie. Abschlussbericht, Bern, Juli 9, 2015; Swiss Economics and Ecofys (2015) Zukünftige Energiemärkte und die Rolle der Netzbetreiber. Abschlussbericht im Auftrag des BfE, Bern, März 16, 2015. Available online at: http://www.acer.europa.eu/official_documents/acts_of_the_agency/references/dsf_final_report.pdf

40 For a detailed explanation of the required improvements mentioned below please refer to: Enadvice (2016) Multi-Client Studie Endkundenflexibilität – Eine Empfehlung zur besseren Nutzung der Flexibilitätspotentiale bei den Schweizer Stromverbrauchern bis 2020. Preliminary Version, Zürich, Dezember 2015.

41 Bundesverband Neue Energiewirtschaft (2015) Recommendations for Deployment of Flexibility in the German Electricity Market. Berlin, September 2015, p. 2. Available online at: http://www.bne-online.de/de/system/files/files/attachment/20150924_bne_Deployment%20of%20Flexibility%20in%20Germany%20-%20Role%20of%20Aggregators_0.pdf

Third, it must be considered whether the central objective to strengthen the responsibility of balance groups might be undermined by interaction processes with aggregators.

Therefore, a decision will have to be taken on basis of an objective estimation concerning the impact of an aggregator model for overall Swiss social welfare.

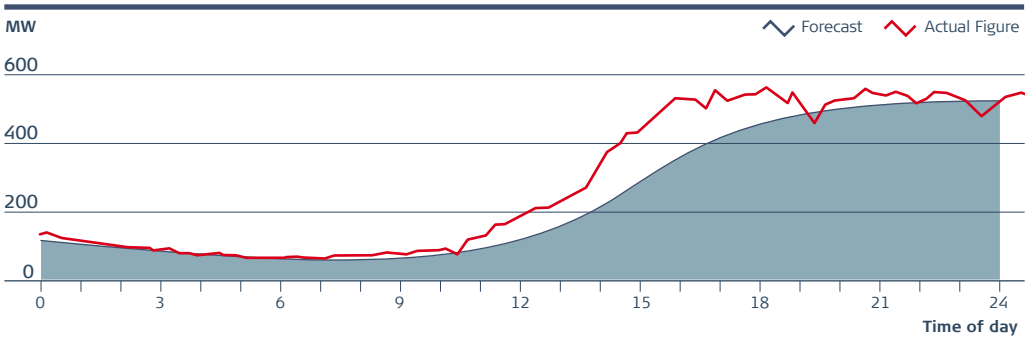
2.3. Introduce balancing responsibility for renewables

Intermittent renewables in Switzerland are currently subsidized under cost-covering remuneration for feed-in to the electricity grid (CRF), and through one-off investment grants.[42]

Renewables that are subsidized under the CRF currently receive a fixed remuneration for each kWh they produce, independent of market conditions and the quality of their generation forecasts. Production from CRF installations is managed by Energy Pool Switzerland, which is responsible for submitting day-ahead production forecasts to Swissgrid.

As illustrated in figure 2, for the example of one German balancing zone, actual production levels for intermittent renewable sources such as wind deviate from forecast values, creating imbalances. Some of these imbalances are compensated during the post-scheduling process. However, neither Energy Pool Switzerland nor the CRF providers are currently responsible for paying the cost of the remaining imbalances. As a result, they only have weak incentives to adjust their output to market conditions, or to improve their forecasting quality. If the current regime is continued, an increasing share of intermittent renewables can be expected to lead to a growing number of imbalances that have to be compensated by the system operator.

Figure 2: Wind feed-in uncertainty on 5th December 2013



Source: Transnet BW

To give an efficient incentive to reduce these imbalances, a stronger exposure of renewable energy generators to market signals would be beneficial.[43] Swissgrid therefore welcomes the suggestions by the Swiss Energy Office (SFOE) to phase out the present support schemes, and replace these possibly with an auction-based, direct marketing premium for new renewable installations.[44] If this scheme is implemented, producers of renewable energy would receive a «premium» equal to the difference between a support level and a reference price, such as the quarterly average Swissix price. The premium could either be fixed by the government, or in an auction. Renewable energy providers would sell their energy to the market either directly, or through a third party service provider. The renewable energy providers or the service provider would then be responsible for

42 Swiss Federal Office of Energy (SFOE) (2014a) One-off Investment Grants. April 2, 2014. Available online at: http://www.bfe.admin.ch/themen/00612/05410/06149/index.html?lang=en

43 ECOFYS (2014) Design Features of Support Schemes for Renewable Electricity. Task 2 Report. Project No. DESNL13116. Utrecht, January 27, 2014, p. 4; ENTSO-E (2014b) Market Design. Policy Paper. Brussels, September 15, 2014, p. 3.

44 Swiss Federal Office of Energy (SFOE) (2014b) Faktenblatt zur Energiestrategie 2050. Direktvermarktung von Stromerzeugungs-anlagen mit Einspeisevergütung. Januar 2014. Available online at: http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=de&name=de_410579823.pdf

any residual imbalances between the energy they have sold and the energy they have delivered. Compared to the current support schemes, they would thus have a much higher incentive to reduce their imbalances.

Consultation questions on chapter 2

Q 3: Do the stakeholder support the Swissgrid proposal to implement a (near) real-time imbalance price?

Q 4: Do stakeholders see a benefit from formally introducing a new role for an independent aggregator that bundles and markets flexible resources on the wholesale market?

Q 5: Do stakeholders agree with the assessment that a balancing responsibility for renewables would be beneficial? Should Swissgrid implement any other measures to achieve a more efficient integration of renewables?

3. Optimize cross-border trading

In recent years, Swissgrid has helped shape cross-border trading mechanisms through a range of initiatives. These have included the establishment of «technical readiness» for market coupling with European partners; active engagement in the European Intraday Platform «XBID»; and the development of new European «Harmonized Auction Rules», for implementation from 2016. The introduction of intraday auctions on the Italian border as well as the forward and intraday allocation on the French border date back to 2012.

Unfortunately, ongoing bilateral negotiations between Switzerland and the EU have led to an increasing degree of exclusion of Switzerland from the European integrated energy market. In particular, Swissgrid was not allowed to participate in market coupling, at the end of 2014. Similarly, prospects to «go live» with other partners in the «XBID» project are doubtful at present, and participation in further, present and future European projects is jeopardised.

While participation in EU projects is thus significantly hindered, there is still the opportunity to engage in bi- or multilateral projects with neighbouring TSOs. Confirming such opportunities, Swissgrid has ordered a legal assessment of the implications of the CACM network code for Swiss cross-border projects in the intraday timeframe.[45] This assessment indicates that Article 1.4 of the CACM network code directly points to the existing market coupling initiative organized in the MRC-Project, as well as to the XBID project,[46] but not to any other future project on the Swiss borders. It can be concluded that additional cross-border projects and improvements can be carried out, as long as these support and do not oppose the main goals of market integration as laid down in the CACM network

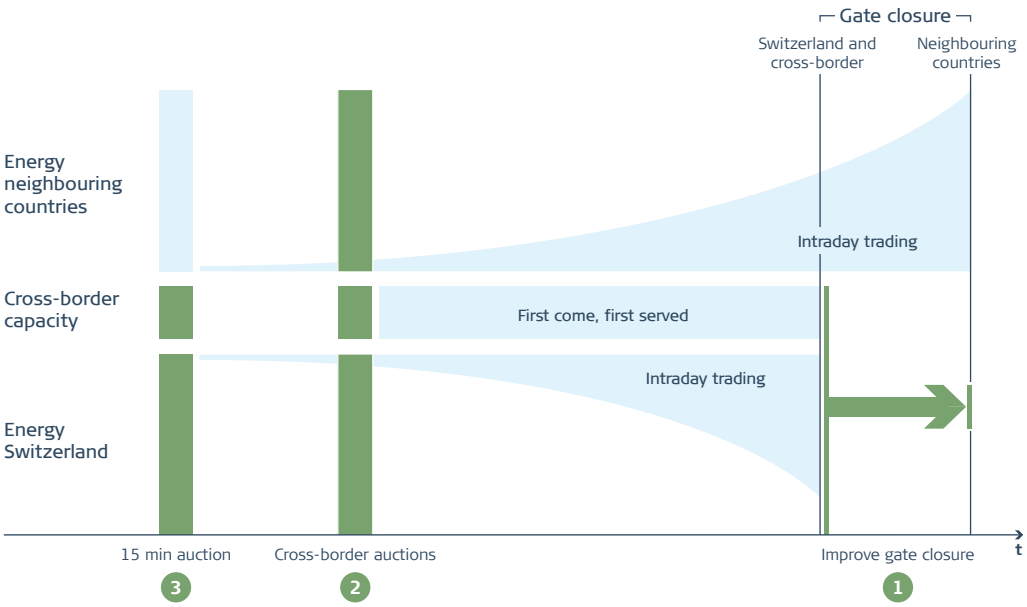
45 The European Commission (2015) Commission Regulation (EU) 2015/1222 of 24 July 2015 Establishing a Guideline on Capacity Allocation and Congestion Management. Brussels 2015. Available online at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015R1222

46 The Multi Regional Coupling project (MRC) includes all relevant TSOs and exchanges. Swissgrid has an observer status in this project organization.

code, even if they are not governed directly by the CACM. The proposed measures in this consultation document clearly support the idea of market integration, as Article 63 of the CACM itself foresees the possibility of complementary regional auctions.

Swissgrid is therefore increasingly focusing on the following incremental improvements to trade across its borders.

Figure 3: Suggested improvements to cross border trading



Source: Swissgrid

1. **Improve gate closure timing** – Cross-border gate closure times for the intraday market could be reduced, to align these with neighbouring countries.
2. **Introduce cross-border auctions** – The present first-come, first-served allocation of cross-border transmission rights in the intraday market could be complemented by opening and possibly closing auctions.
3. **Introduce 15-minute intraday call auction between Germany and Switzerland** – The introduction of a joint intraday call auction covering Germany, Switzerland and possibly Austria should be evaluated.

These steps are expected to have a higher chance of short-term realisation, though the relationship between the EU and Switzerland may be decisive here, too.

3.1. Improve cross-border intraday gate closure times

On intraday markets, price and volume volatility usually increases strongly close to «gate closure time», which is the latest moment that a nomination to the TSO can be performed. This increase in volatility is an indication of system balancing challenges in the market, and is especially observed in the last hours before delivery. This observation is accentuated in countries with late gate closure times, for example 15 minutes before delivery with a 15-minute balancing resolution, such as in Germany, Austria and Switzerland. As a result of this volatility, this short end of the intraday market is of special interest for flexible generators.

The actual intraday «lead time» for trades between Germany, Austria and Switzerland at the spot exchange EPEX SPOT is equivalent to 60 minutes. This depicts the latest time a cross-border deal can be closed on this platform. It results from the present cross-border gate closure time, set by the TSOs, of 45 minutes, and calculating a 15 minute nomination delay for EPEX SPOT's clearing house European Commodity Clearing (ECC). After the end of cross-border trading, at 60 minutes before delivery, the Swiss market is very illiquid. Trading on EPEX SPOT within Switzerland has the same, one-hour lead time.

In contrast, intra-German transactions can be closed at EPEX SPOT with a lead time of 30 minutes prior to physical delivery, corresponding to a (TSO-related) gate closure time of only 15 minutes. As a result, the German and Swiss intraday markets cannot be co-optimized in the last 30 minutes of intraday trading in the German market (between «t-60» to «t-30»). This situation is illustrated in the following table with present lead times by EPEX SPOT and its clearing house European Commodity Clearing (ECC) on 16 July 2015.

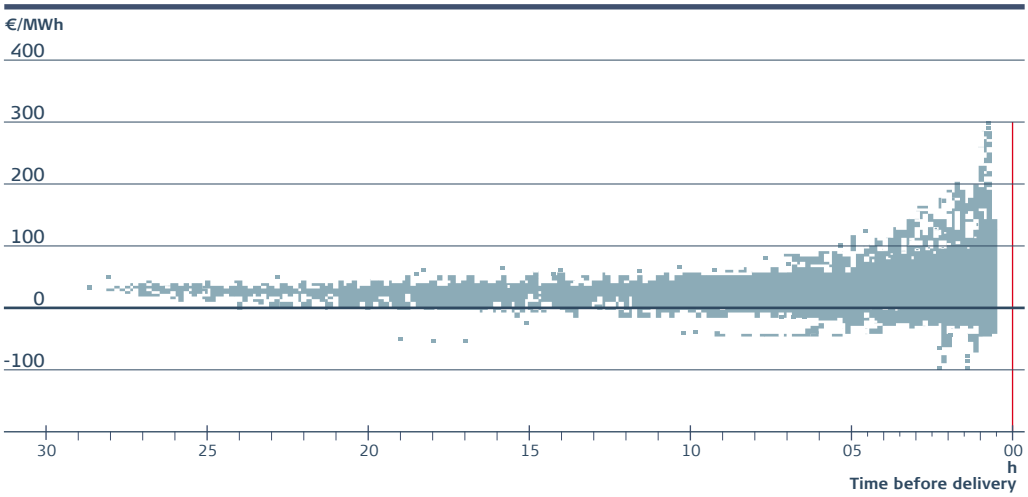
Table 3: Present intraday lead times at the EPEX SPOT intraday markets.

Trading	Lead time today
within Germany	30 minutes
within France	30 minutes
within Austria	30 minutes
within Switzerland	60 minutes
between Germany and France	60 minutes
between Germany and Austria	60 minutes
between Germany and Switzerland	60 minutes
between France and Switzerland	60 minutes

Source: EPEX Spot (https://www.epexspot.com/en/product-info/intradaycontinuous/intraday_lead_time)

This problem of co-optimizing the German and Swiss intraday markets could be unimportant if there were relatively constant prices during the whole trading period of the intraday market. However, figure 4 shows how price formation changes over time. It illustrates average prices for hourly summer contracts on the German intraday market (y-axis) over time, until delivery of the electricity (x-axis). It is clear that price volatility increases as the contract trading period nears gate closure. An analysis of additional products, such as off-peak and quarter-hourly contracts, leads to the same finding.

Figure 4: Transactions in the German intraday market Jul to Sep 2014



Source: Own calculations for the hourly intraday contracts based on data from EPEX Spot

Assuming that a high price indicates high demand, the analysis above suggests that Swiss flexible generation may provide welcome support for German demand. At present, however, Swiss generators cannot participate in the final trading phase, and so cannot increase social welfare by providing additional flexibility as the market nears gate closure.

The challenge, therefore, is to reduce cross-border lead times, to allow the participation of Swiss players in the continuous intraday trading segment of the German market, and vice versa. Such a market improvement has been studied in a joint study by Swisselectric and Swissgrid, supported by Pöyry as an external consultant, and has been proposed by several other stakeholders.

Technical framework on intraday gate closure time

It is clear that not only is the European transmission grid physically interconnected, but TSOs are also in continuous communication and data exchange, to ensure stable system operation. Therefore, an objective to reduce lead times with neighbouring countries immediately raises the question whether other TSO interfaces may be affected, thus impeding the plan to optimize lead times.

One central international area of co-operation amongst TSOs is the grid security calculation. Current calculation processes utilize control block overlapping data from a so-called «Vulkanus» IT system. However, this data is not lead-time sensitive. Therefore, the grid security calculation is not a limiting factor regarding the intention to reduce lead times.

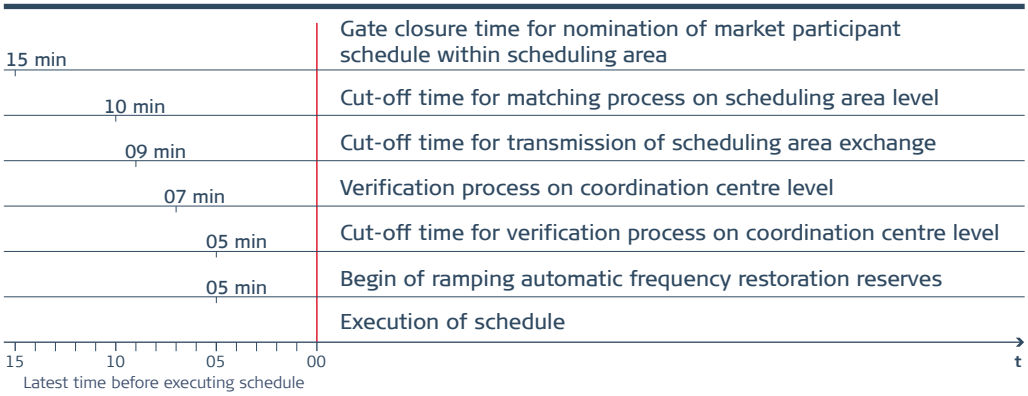
However, lead times play a central role in the international schedule management of TSOs. From a technical point of view, the lead time is a configurable unit that has to be defined for transactions amongst two or more TSOs to guarantee smooth processes. In this context, the expected implementation of a revised, so-called Policy 2 has a central role.[47] This new Policy 2 is expected to regulate the implementation of trans-national

47 ENTSO-E (2015a) Policy 2: Scheduling and Accounting. Brussels, July 10, 2015, p. 13

operational framework agreements (OFAs). These OFAs are expected to see a lead time reduction from currently 45 minutes to 15 minutes in the future.

Figure 5 outlines the expected schedule management time-line, according to the revised Policy 2. It is expected to be binding in the future,[48] but the implementation date is not yet officially announced.

Figure 5: Deadlines before schedule execution



Source: Intraday Deadlines for ENTSO-E RG CE Scheduling Process based on the ENTSO-E Operational Handbook

The implementation of the reduced lead times will depend on a greater degree of business process automation. This means that the opportunities for manual interventions in schedule management processes will be limited. Because of these time constraints, automated market rules will be applied in case of missed matches.

Possible resulting lead times

Lead times on the French and Italian border will need to be co-ordinated with the TERRE project. For the remaining borders, Swissgrid is aiming to improve lead times for intraday trading both across borders and within Switzerland. Both the lead times for the TERRE project and the lead times within Switzerland will need to be co-ordinated with the lead times for the Integrated TSO Market.

48 UCTE (2009) Operational Handbook (OH) Policy 2: Scheduling and Accounting. Final Version. Approved by the Steering Committee on March 19, 2009. Brussels, p. 2–13. Available online at: https://www.entsoe.eu/fileadmin/user_upload/_library/publications/entsoe/Operation_Handbook/Policy_2_final.pdf

3.2. Introduce intraday border auctions

In Europe, the dominant trading mode in the intraday timeframe is «continuous trading», in which trades are continuously closed. For cross-border trades this principle is combined with the «first-come, first-served» principle, in which cross-border capacity is explicitly or implicitly (in combination with the traded energy) awarded to the first requester. Due to the continual increase in intermittent generation, the importance of efficient, well-functioning intraday markets is also increasing.

However, first-come, first-served allocation is not considered to be the most efficient, from an economic perspective. Its drawbacks are that the valuation of capacity rights by bidders is not made explicit, and, more importantly, that scarce capacity is not allocated efficiently. In the absence of a liquid and well-functioning secondary market for capacity rights, allocation is not expected to be to bidders with the highest willingness to pay. From a technical perspective, bidders with the fastest bidding infrastructure have an advantage compared to bidders that use manual processes to apply for capacity rights.

Empirical observation shows that this reduces market efficiency, especially at the Swiss-French border, where significant cross-border transmission capacities are made available at the start of intraday trading. Here, market participants book capacities partly in an automated way as early as possible, before they even know whether they will use it. If the capacity is not needed, participants can overcome the obligation to use it, as stipulated in the respective allocation rules, by booking the same capacity volume in the opposite direction, even though this behaviour is not in line with contractual obligations.

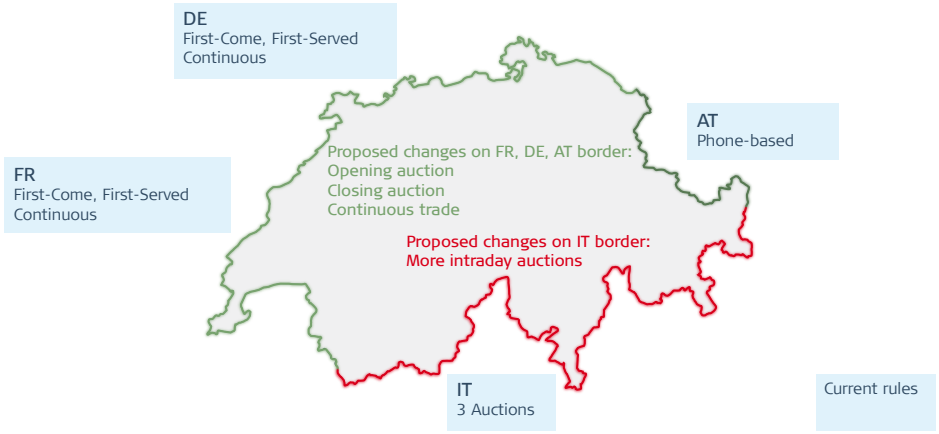
Clearly, in combination with an increasing liquidity and trading frequency in the intraday market, such market behaviour draws into question the efficiency of the «first-come, first-served» principle. The principle seems to be inefficient, increasing the market entry barriers for small players, and resulting in a distortion of competition. From an operational perspective, opportunities for all market participants to balance schedule deviations on the intraday market will become more and more limited, which might lead to reduced grid stability.

The introduction of auctions seems a promising approach to deal with the increasing significance of the intraday market for system optimisation. Candidate auctions for investigation are the introduction of intraday opening and intraday closing auctions, to deal with increased market liquidities on both sides of the intraday time frame. The proposed adjustments are summarized in figure 6. They are in line with the network code on capacity allocation and capacity management (CACM),[49] which explicitly mentions the option to implement «complementary regional intraday auctions (...) within or between bidding zones».[50]

49 The European Commission (2015) Commission Regulation (EU) 2015/1222 of 24 July 2015 Establishing a Guideline on Capacity Allocation and Congestion Management. Brussels 2015. Available online at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015R1222

50 The European Commission (2015) Commission Regulation (EU) 2015/1222 of 24 July 2015 Establishing a Guideline on Capacity Allocation and Congestion Management, Brussels 2015, Article 63. Available online at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015R1222

Figure 6: Proposed changes to the allocation of transmission rights



Source: Swissgrid

We now present the proposed approaches for the borders with France/Germany, the Austrian/Swiss border as well as for the Swiss/Italian border. For historical reasons, the approach varies according to the border. In the medium term, Swissgrid aims to implement implicit intraday auctions at all Swiss borders.

Proposal for borders with France and Germany

Swissgrid proposes to enhance the existing market design on borders with France and Germany through the implementation of regional auctions for intraday capacity rights. The intention is not to replace continuous trading activities, but to introduce at least one intraday opening and possibly one intraday closing auction,[51] dealing with increased market liquidities on both sides of the intraday time frame.[52]

Continuous trading activities are still important to provide sufficient flexibility to the market, given that auctions usually require a lead time. An alternative, purely auction-based market design that offered flexibility, for example through hourly auctions, is considered less beneficial, as it would remove the social welfare benefit from the bundling of liquidity.

Through the introduction of intraday capacity opening and closing auctions, imbalanced market parties will have much better opportunities than at present to use the capacity they need. Furthermore, the proposed auctions will reflect the true economic value of intraday capacities, through the prices that market participants are willing to pay for capacity rights. The proposal will also increase market transparency.

Swissgrid prefers the implementation of implicit, rather than explicit, auctions. Implicit auctions are more transparent and efficient. Furthermore, their introduction has been proposed by the CACM. According to the CACM, «capacity should be allocated in the

51 In this context a feasibility study should be conducted in order to evaluate the «optimal» number of auctions to be conducted. Furthermore, the desirable point of time to conduct the auctions has to be defined. The auction times should attract as many market participants as possible and should therefore not be held in parallel to e.g. day-ahead auctions.

52 This market design measure is in line with the network code proposal draft on capacity allocation and capacity management. It explicitly mentions the option to implement «complimentary regional intraday auctions (...) within or between bidding zones». The European Commission (2015) Commission Regulation (EU) 2015/1222 of 24 July 2015 Establishing a Guideline on Capacity Allocation and Congestion Management. Brussels 2015, Article 63. Available online at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015R1222.

(...) intraday market time-frame using implicit allocation methods, in particular methods which allocate electricity and capacity together».[53]

Given the CACM request to apply exclusively implicit allocation procedures for capacity on the intraday time frame, Swisssgrid favours combining implicit continuous trading with implicit auctions in the future. This would help avoid automated booking of partially unused capacity, as capacities would only be booked in the event of a trade taking place. It would also mean that OTC intraday trading transactions would no longer be possible. However, as noted above, that is in line with the goals of the European Commission and the capacity-related network codes.

Proposal for the border with Austria

The previous proposal is of particular relevance to the French and German border. The situation at the Austrian-Swiss border is different from a liquidity perspective. At present, intraday trading activities here are very limited, and changes to the market design changes are not a top priority. However, the telephone-based booking of capacities appears out-dated, and should be replaced by a more advanced and more efficient approach. In the medium-term, Swissgrid proposes also to implement the French/German design proposal at the Austrian/Swiss border.

Proposal for the border with Italy

In 2012, Terna and Swissgrid introduced explicit, intraday auctions on the Swiss/Italian border. This intraday mechanism operated by the Joint Auction Office commenced on 19 June 2012 and comprises two auction sessions. The first auction is performed on D-1 at 15:40pm, and the second on the day of the delivery at 10.50am. Participants thus acquire physical transmission rights which they may exercise with the relevant TSOs. There is no opportunity to transfer or re-sell the allocated intraday capacity: there is no secondary market.

The implementation of continuous intraday trading on this border seems challenging, as Italy does not have a continuous intraday market today. In the absence of an implicit auction structure, an alternative approach to increase market efficiency might be to increase the number of intraday auctions from two today, to as many as five. This measure would lead to closer alignment of the Swiss and Italian market structures, as five implicit intraday auctions are presently held on the Italian market.

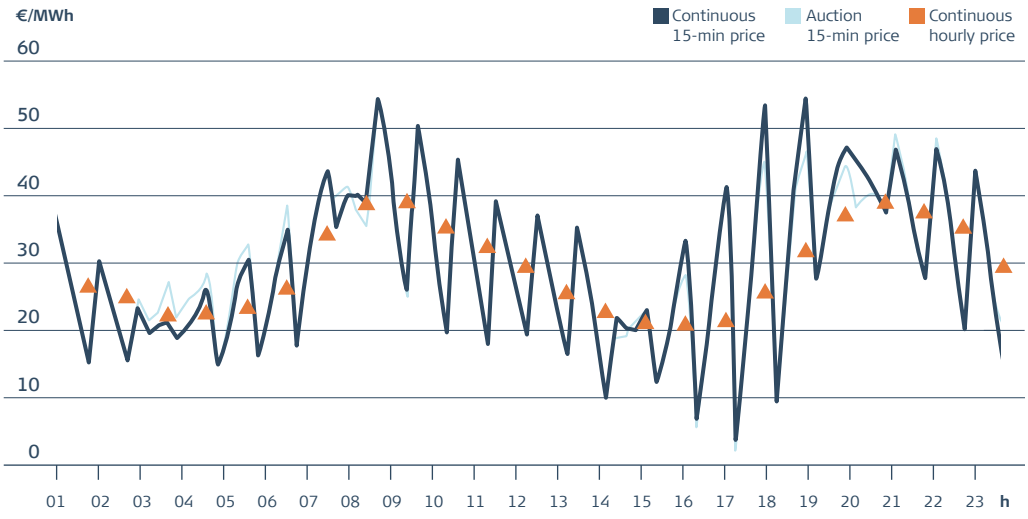
53 The European Commission (2015) Commission Regulation (EU) 2015/1222 of 24 July 2015 Establishing a Guideline on Capacity Allocation and Congestion Management. Article 63. Brussels 2015, p.2, Comment 13. Available online at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015R1222

3.3. Introduce a 15-minute intraday call auction between Germany and Switzerland

EPEX SPOT successfully launched an intraday call auction for 15-minute contracts on the German power market in December 2014. This auction allows trading of the 96 quarter-hours for delivery the next day simultaneously. The market benefits from a concentration of liquidity at the beginning of the intraday process and the auction provides a transparent reference price for the 15-minute contracts. The auction on the German intraday market takes place daily at 3 pm, year-round, before the opening of the continuous Intraday market for 15-minute contracts at 4 pm. The auction runs on the EPEX Trading System (ETS) used for EPEX SPOT's day-ahead markets.

As figure 7 shows, the 15-minute contracts assist in the fine-tuning of portfolios, after the day-ahead auction for hourly contracts at noon, and facilitate trading for intra-hour variations in production and consumption. The 15-minute auction is incorporated in the intraday market segment, as it is held after the day-ahead nomination deadline at 2.30 pm in Germany. The 15-minute prices that emerge on the continuous intraday market remunerate more accurately flexible capacity able to respond to 15-minute variations in production and consumption. The auction further fosters this accuracy by concentrating liquidity and creating the most robust possible price reference.[54]

Figure 7: German intraday price average comparison between hourly and 15-min products



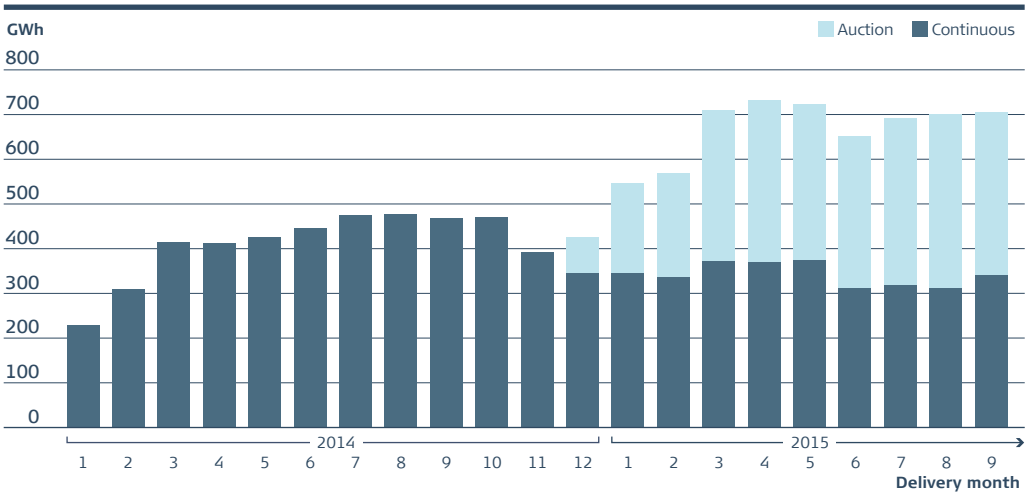
Source: EPEX

Figure 8 shows how market participants have accepted the German intraday call auction, with traded volumes now greater than the equivalent 15-minute continuous intraday trading volumes.[55]

54 EPEX Spot (2014) Successful Launch of 15-Minute Intraday Call Auction in Germany. Press Release, Leipzig/Paris, December 9, 2014. Available online at: https://www.epexspot.com/en/press-media/press/details/press/_Successful_launch_of_15-Minute_Intraday_Call_Auction_in_Germany

55 EPEX Spot (2015) EPEX SPOT and APX trading results of September 2015. Amsterdam/Bern/Brussels/Leipzig/London/Paris/Vienna. October 1, 2015.

Figure 8: 15-minute intraday trading volumes Germany



Source: EPEX

The Swiss continuous trading intraday market segment of EPEX Spot has a relatively low volume, equivalent to about 5 percent of the combined Austrian and German volumes.[56] The integration of Swiss market participants into the German Intraday Call Auction would bring additional liquidity into the existing call auction. In addition, flexible Swiss hydropower generation assets could offer flexibility for the German market during the auction. Extension of the intraday call auction to Swiss participants could therefore be a win-win for both markets.

This concept of a joint, 15-minute call auction between Switzerland and Germany was assessed during a joint study of Swisselectric and Swissgrid, with Pöyry as an external consultant. The concept was considered worthwhile, with both parties therefore committing to investigate further. Swissgrid has begun evaluations with relevant stakeholders, and in particular the neighbouring German TSOs and EPEX SPOT.

Technical framework for the 15-minute intraday call auction

The new market design concept would involve the establishment of an intraday call auction for the Swiss market zone. Under such a Swiss intraday call auction concept, Swissgrid would implicitly allocate the available capacity between Switzerland and Germany, via the auction algorithm, in co-operation with the German TSOs and the PX.

Implementation would require the re-definition of, or changes to, a number of processes between the participating TSOs, the exchange and the clearing house of the exchange. First, the TSOs would need to inform the exchange and market parties on available intraday capacities. The exchange would then need to define the price matching algorithm for the two participating market areas, Germany and Switzerland, based on an implicit allocation of the available intraday capacity. The clearing house would have to send out the respective schedules for the physical electricity flows, according to the matched bids of the market participants. The received schedules would then have to be integrated into automated control procedures on the TSO side. Market participants and the exchange would then receive a schedule confirmation/rejection via a communication protocol.

56 EPEX Spot (2015) EPEX SPOT and APX trading results of September 2015. Amsterdam/Bern/Brussels/Leipzig/London/Paris/Vienna. October 1, 2015.

A significant challenge for TSOs would be to provide the required data on available intraday capacity ahead of the intraday call auction, which currently takes place at 3.00pm on D-1 for the German market. Under the present established processes, balance groups send their day-ahead schedules to the TSO until 2.30 pm in the day-ahead timeframe. An additional time slot from 2.30 until 3.30 pm gives balancing groups the opportunity to adjust their schedules, in case of mismatches with schedules from counterparties or TSO data. At 3.30 pm the European control block reconciliation process starts, and the European grid security for the next day is calculated. Once this process is completed, the available transfer capacity for the continuous intraday trading is published, at around 6.00 pm. As a result, the current process would be unable to meet the objective of running a 3.00 pm intraday call auction which requires information on available transfer capacity (ATC).

The present correction cycle would therefore have to be abandoned, to provide the required ATC data prior to 3.00 pm. Measures to reach this objective would shorten or eliminate the time period for the correction of mismatching schedules. This would impose a higher risk on market participants. The composition and necessity of sub-processes in the areas of control block reconciliation and grid security calculation should be critically evaluated, as they might offer potential to reduce the current process duration. An external analysis of the Swissgrid proposals has indicated that it would be useful to investigate further a concept where cross-border capacities are partly allocated to an intraday call auction and partly to continuous trading activities.[57]

An alternative solution would be to adjust the current point of time of the intraday call auction, according to the new, proposed process duration. However, this would also require significant changes to German market processes.

Consultation questions on chapter 3

Q 6: Do the stakeholders support the proposed measures for an optimization of cross-border trading?

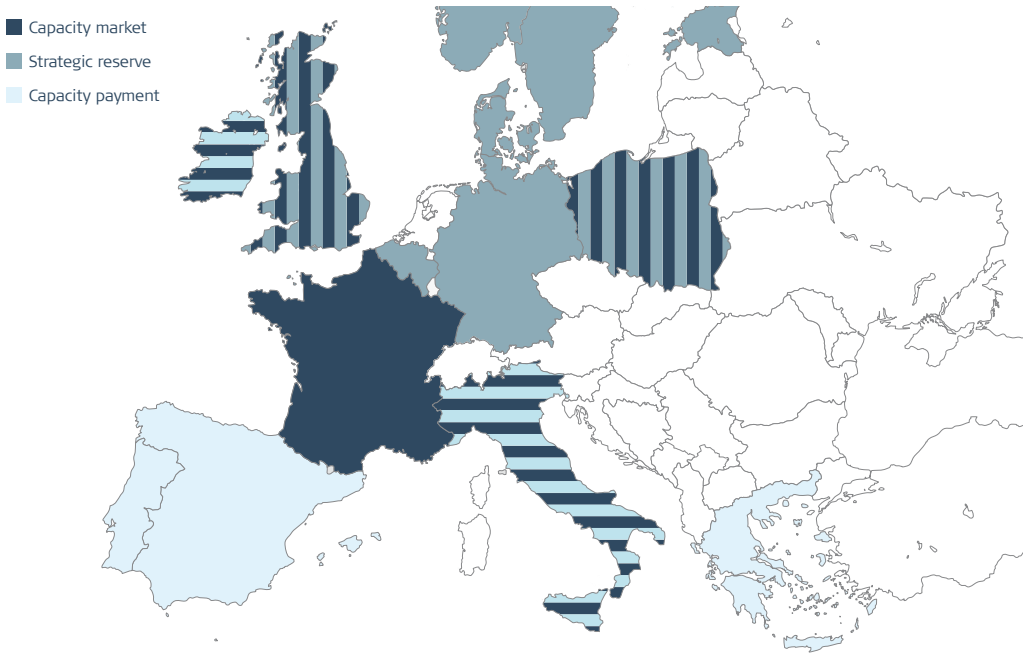
Q 7: Do stakeholders propose additional measures that are not mentioned in the consultation document in order to increase the efficiency of cross-border trading?

57 Verband Schweizerischer Elektrizitätsunternehmen (VSE) (2015) Machbarkeitsstudie für die grenzüberschreitende Vermarktung von Flexibilität. Kommission Energiewirtschaft – Einschätzung. Aarau, November 2015, p. 4.

4. Move towards a regional approach on security of supply

Recent, national discussions on adequacy across Europe have given rise to adequacy monitoring and the introduction of a variety of different national capacity mechanisms. The resulting patchwork risks distorting the European energy market (see figure 9).

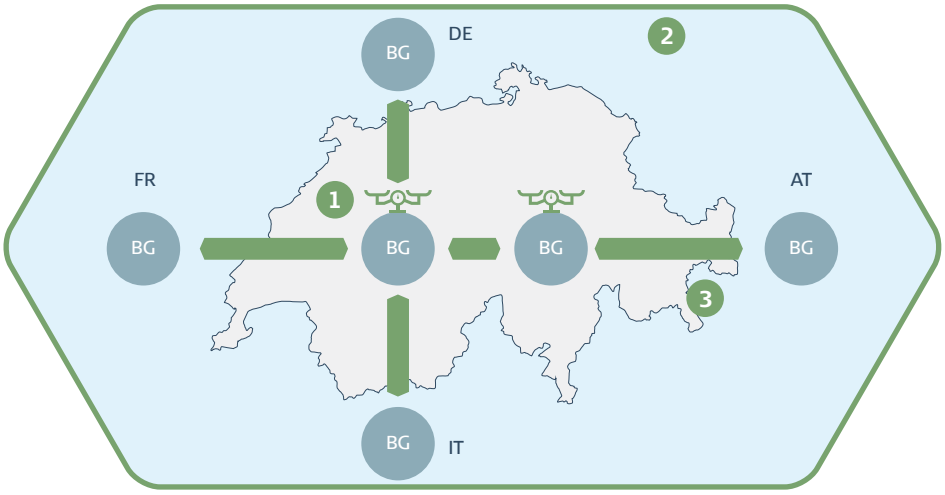
Figure 9: Overview of national capacity mechanisms



Source: Swissgrid

Swissgrid suggests three important steps, illustrated in figure 10, to move towards a more coordinated, regional approach. These measures depend partly on the development of Swiss-EU relations, in contrast to the cross-border measures presented in chapters 2 and 3. As a result, these further proposals remain at a conceptual level for now.

Figure 10: Suggested measures to ensure generation adequacy



Source: Swissgrid

1. **Strengthen adequacy responsibility for balance groups** – In combination with the proposed measures for strengthening price signals (see chapter 2), stronger balancing responsibility, including securing end-customer supply in tight situations, will increase the demand for hedging products and thus drive more efficient investment decisions.
2. **Improve cross border co-operation** – Swissgrid suggests improving regional adequacy analysis by implementing joint adequacy assessments and, in addition, suggests developing agreements on the handling of simultaneous scarcity situations, to enable reliance on contracted foreign capacity.
3. **Allow for cross-border trading of adequacy** – To allow capacity from different countries to compete on a level playing field, it is important to enable cross-border trading of adequacy, both for countries with a capacity mechanism and for countries without a capacity mechanism.

We describe these measures in sections 4.1 to 4.3 below.

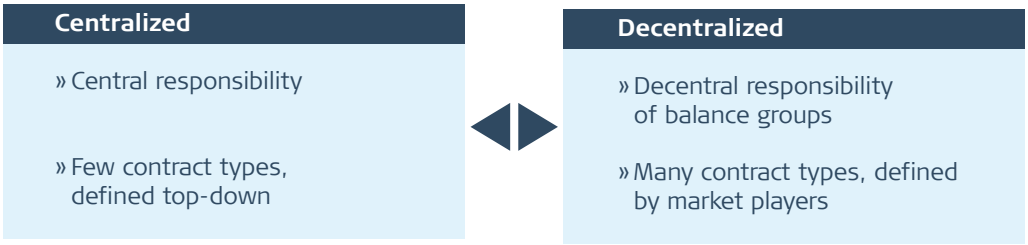
4.1. Strengthen adequacy responsibility for balance groups

Balance groups within Switzerland are responsible for ensuring a balanced position. As a last resort, any balance group which repeatedly fails to achieve this balance faces the risk of contract termination. Following growing imbalances as a result of speculative trades, Swissgrid proposed in an earlier consultation to sharpen balancing incentives by introducing additional imbalance limits at two hours before delivery, and at the close of intraday trading. The size of the proposed imbalance limits would depend on the amount of financial collateral that is deposited up-front as a security. Repeated violation of these imbalance limits would lead to escalation of imbalance charges,up to five times the normal imbalance charge.

It is important to note that an unavailability of liquidity in the market does not exempt market parties from their obligation to ensure a balanced position. In situations where there may be insufficient generation capacity, and the availablity of imports is unsure, balance groups therefore have a responsibility to hedge against the risk of an open position exposing them to imbalance penalties and contract termination. The measures outlined in chapter 2 may further increase the incentive to fulfill balance group responsibilities by raising the imbalance price in situations of system scarcity.

Figure 11 below shows how the current approach corresponds with a decentralized responsibility, where the individual balance groups rather than a centralized institution have the responsibility to ensure adequate investment levels.

Figure 11: Centralized vs. decentralized approach to security of supply



Source: Swissgrid

In order to hedge against these risks, balance groups can either construct additional generation capacity or DSR, manage existing resources such as hydro storage more efficiently, or purchase a hedging contract which gives them access to the physical capacity of other providers when needed. At present, there is no regulated market for this type of hedging contract. Market design reform proposals to allow such hedging are found in section 4.3.

Unlike under a centralized approach to security of supply, we expect that products will also be developed by the market, resulting in a greater variety of contract types than in the case of a centralized market.

4.2. Improve cross-border co-operation

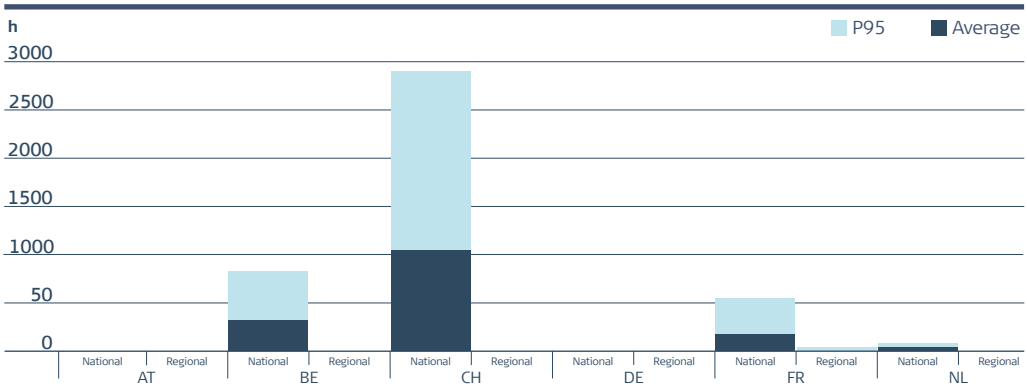
National approaches to assuring generation adequacy which underestimate or prevent the contribution of foreign capacity can lead to the over-procurement of national generation capacity. The resulting overcapacity leads to a suppression of power prices. In order to avoid such overcapacity, Swissgrid is actively working on joint regional and European assessments of generation adequacy and proposes measures to improve the reliability of contracted imports during periods of simultaneous scarcity.

Joint assessments

Together with the other TSOs in the PLEF region Swissgrid has recently completed a joint assessment of generation adequacy in the region.[58] The results from this study corroborate the value of co-operation between countries in the PLEF region on supply adequacy. As outlined in figure 12, Switzerland is highly import-dependent in winter. The estimated average value and 95 percentile (P95) of the loss of load events in an isolated national assessment is much higher than a corresponding estimate for a regional assessment, which takes into account the contribution of foreign generators. Thus, a national approach to generation adequacy which ignores imports will grossly overestimate capacity needs, and as a result will lead to over-investments.

Besides the PLEF SG2 on Security of Supply, Swissgrid is also active in the ENTSO-E SA&MM (System Adequacy & Market Modelling) working group. In particular, Swissgrid is an active contributor in the TF ADAM (Task Force Adequacy Assessment Methodologies) pilot phase of consolidating and applying a target methodology for regional and pan-European adequacy assessments.

Figure 12: Estimated loss of load events – national vs. regional approach



Source: Swissgrid based on «PLEF Generation Adequacy Assessment 2015»

Reliability of contracted imports

In order to improve the reliability of contracted imports during simultaneous scarcities, present rules for capacity allocation may need to be amended. Article 72 of the Network Code on Capacity Allocation and Congestion Management (CACM)[59] and Articles 12 and

58 Pentalateral Energy Forum Support Group (2015): «Generation Adequacy Assessment». Available online at: https://www.swissgrid.ch/dam/swissgrid/current/News/2015/PLEF_GAA-report_en.pdf
59 Commission Regulation (EU) 2015/1222. Brussels, 24 July 2015. Available online at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R1222&from=EN

19 of the Emergency Restoration Network Code (ER)[60] allow TSOs to restrict export flows during emergency situations, and so prevent blackouts in their control area. As a result, any generation capacity contracted from abroad will be less reliable than national generation capacity. For this reason, most of the capacity mechanisms as currently designed in Europe would rather pay for new generation units within their own country than to contract existing generation capacity from foreign generators.

As a first step to avoid resulting over-capacity, it is therefore important to ensure that dispatch during emergency situations prioritizes forward capacity contracts over load shedding. A recent joint declaration by European governments was a first step in this direction, where governments declared their intention to «not restrict cross-border trade of electricity including in times of high prices».[61] However, further detail is required, to convert this into a binding commitment to give cross-border capacity contracts a higher priority than local curtailments, which would then allow a modification of the network codes.

60 ENTSO-E (2015b) ENTSO-E Network Code on Emergency and Restoration. Brussels, March 25, 2015.
61 BMWI (2015) Joint Declaration for Regional Co-operation on Security of Electricity Supply in the Framework of the Internal Energy Market. Luxemburg, June 8, 2015. Available online at: http://www.benelux.int/files/4414/3375/5898/Jointdeclaration.pdf

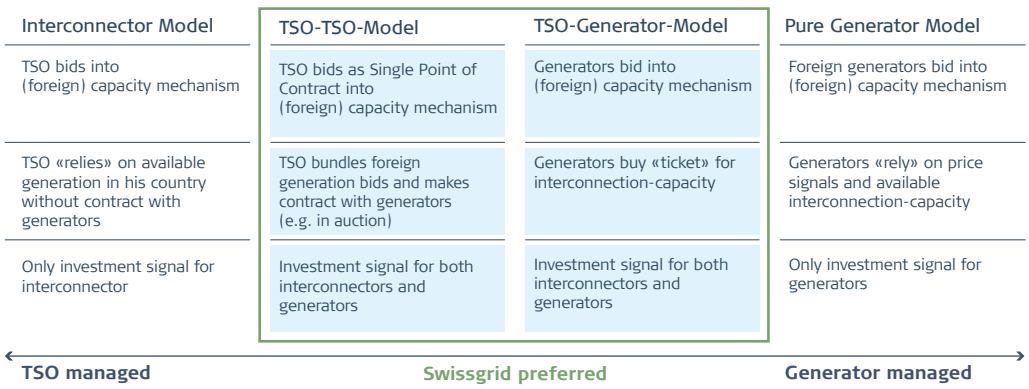
4.3. Enable cross-border trading of adequacy

To incentivize an efficient allocation of power plants between two countries, a power plant in either country should be able to sell its capacity into the capacity mechanism or any other market for hedging products of a neighboring country up to the limits imposed by network constraints. As a pre-condition for this to work, the reliability of contracted imports during scarcity needs to be guaranteed, as described in the previous section.

Countries with a capacity mechanism

For countries with a capacity mechanism, cross-border trading of adequacy could be enabled by explicit participation of foreign capacity,[62] with four alternative approaches shown in figure 13 and described below.

Figure 13: Models for explicit participation in foreign capacity mechanisms



Source: Swissgrid

In the case of an Interconnector Model, the owner of the transmission line bids into the capacity market. The transmission owner relies on available generation in the neighboring country, but does not have contracts with generators to guarantee their availability. Given that the neighboring country may not export during scarcity, the interconnection capacity is strongly de-rated.[63] This is the preferred model in the British capacity market. This model provides incentives for investment in interconnectors, but does not provide additional incentives for investing in foreign generation capacity.

The opposite extreme is shown on the right hand side of figure 13. Under a Pure Generator Model, foreign generators bid directly into the capacity mechanism and rely on the availability of interconnection capacity, without securing the capacity by buying transmission rights. This type of approach would provide incentives for investment in foreign generation capacity, but does not provide incentives for investment in interconnectors.

Neither of these approaches leads to adequate investment incentives. The relative value of new generation or interconnection capacity depends on whether the contribution to supply adequacy is limited by insufficient interconnection or generation capacity.

62 Some markets such as France implicitly assume a contribution of foreign generators towards energy security by reducing the procurement targets correspondingly. However, foreign generators are not remunerated for this service and do thus not have an investment incentive.

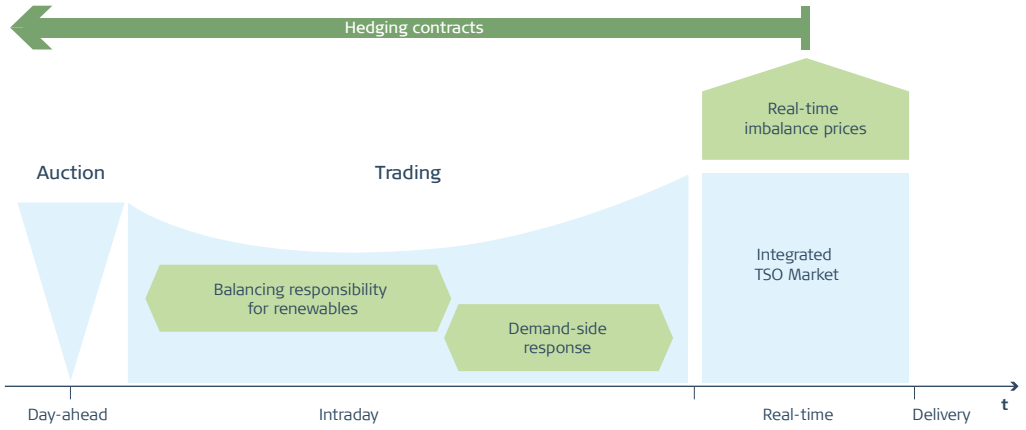
63 Department of Energy and Climate Change (DECC) (2015) Electricity Market Reform. Announcement of De-rating Methodology for Interconnectors in the Capacity Market. London, February 2015. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404260/Inteconnector_de-rating_methdology_final_final.pdf

Swissgrid therefore proposes that participation in foreign capacity mechanisms should be regulated under a TSO-TSO Model or a TSO-Generator Model. In the case of a TSO-TSO Model, the TSO of any neighboring country would participate in a capacity market, but would be obliged to sub-contract the required generation capacity to fulfill its export obligation. In a similar way, for a TSO-Generator Model, the generators of any neighboring country would participate in a capacity market but would be obliged to sub-contract the required transmission capacity to fulfill their export obligation.

Countries without a capacity mechanism

For countries without a capacity mechanism, trading of adequacy across borders could be enabled by establishing interconnected markets for hedging products. If the proposed measures for improving the price signal (see section 2) are implemented, they will result in the risk of a growing financial penalty from being imbalanced. In particular, if scarcity prices are implemented, market players that have contracted or produced less energy than they consume during a scarcity period may face a very high penalty. As illustrated in figure 14, to protect against this risk, there will therefore be a growing need to establish markets for suitable hedging products.

Figure 14: Demand for hedging contracts as a result of improved price signals



Source: Swissgrid

One possible solution could be to introduce a market for physically-backed option contracts with different strike-prices and delivery periods that could be exercised in day-ahead markets, or until the close of trade in intraday markets. Both financial and physical options grant the option holder the right to buy the respective energy volume at the exercise time for a price that is no higher than the strike price.

For smaller companies, in particular, an option contract that can be exercised until the close of trade could be helpful to protect against the risk of higher imbalance prices as a result of the measures proposed in section 2 of this document. At the same time, option contracts would reduce the incentives for sellers to exert their market power during scarcity situations.[64]

64 Cramton P. and Stoft S. (2008) Forward Reliability Markets: Less Risk, Less Market Power, More Efficiency. Utilities Policy, 16, 194-201, 2008.

In addition, the buyer of a physical option contract with an exercise time up to the close of trade could ensure that he achieves a balanced position, even if he is not able to do so in the intraday market. The originator of such an option contract, on the other hand, would need to ensure that he can physically re-balance the position of the contracting party between the time when the option is called and the delivery time. Compared to a financial option contract, this would require a number of additional monitoring measures, shown in table 4 and described in more detail below.

Table 4: Verification requirements for international markets in financial or physical options.

	Financial options	Physical options
Prequalification	Sellers need to prove: » Sufficient liquidity	Sellers need to prove: » Sufficient liquidity » Sufficient generation capacity and transmission rights
Procurement	Bidding volumes restricted by: » Risk limits of each player	Bidding volumes restricted by: » Risk limits of each player » Transmission limits
Delivery	Sellers need to: » Pay (strike price – reference price)	Sellers need to: » Sell energy at strike price » Produce energy when called or procure it in the market

Source: Swissgrid

During the prequalification phase, the seller of any type of option would need to demonstrate sufficient liquidity to fulfil the financial obligations of his contract. In addition, the seller of a physical option would need to demonstrate the ability to adjust his physical injection to compensate for any imbalances that could result from an activation of the option. Foreign providers would additionally need to hold the corresponding transmission rights or tickets, to ensure that they are hedged against price spreads and can deliver their energy to end-consumers.

During the procurement phase, it should be ensured that the total volume of options sold does not exceed the risk limits of each player. In the case of physical options, this consideration of volumes would include the limitations imposed by transmission capacity.

Finally, during the delivery phase, the seller of a financial option only needs to pay the difference between the strike and the reference price. For a physical option, it should be verified whether the seller fulfilled his obligation to close the imbalance by buying or producing the required energy when the option was called.

Most of these monitoring activities would most likely be carried out by the TSOs of the connecting countries. To enable the participation of foreign providers, there would thus be a need for a data sharing agreement or a shared regional capacity register for participating countries.

Consultation questions on chapter *4*

Q 8: Do the stakeholders agree with the assumption that adequacy responsibility of balance groups in combination with a strengthened price signal will increase market efficiency?

Q 9: Do the stakeholders agree that balancing responsibility should include the prognosis and, if necessary, forward hedging of sufficient resources for end-customer supply?

Q 10: Do the stakeholders consider the proposed hedging products to be appropriate for the hedging of potentially volatile imbalance prices? Are there other proposals?

5. Next steps in the consultation

5.1. The consultation process

Swissgrid has been actively participating in and contributing to the European market design discussion for many years. We recognize that the efficient functioning of the European internal market can only be increased through a clear and open dialogue between all stakeholders in Europe. Swissgrid has published several recent contributions, for example under the theme of «Flexibility Markets».[65] Inside Switzerland, Swissgrid has been seeking to improve the functioning of markets, in collaboration with the Swiss electricity industry. Through intense co-operation in various platforms and initiatives, Swissgrid has explored the feasibility of market design ideas, complementing these with existing initiatives from within Europe and from the United States.

The present document is the result of a national and international dialogue for market proposals. Despite intense co-operation with particular national and international market participants in the development of these proposals, it is Swissgrid policy to involve actively all relevant external stakeholders in reviewing documents such as these.

For this purpose, Swissgrid decided to conduct alongside this document a consultation process with Swiss and international balance groups, foreign transmission system operators (TSOs), power exchanges, industry associations, and research institutions, to name a few. Our aim is to invite experts to comment on our ideas.

The steps in this informal consultation process are outlined in figure 15 below. Responses to the consultation questions will be required by February 16th 2016. Swissgrid will confirm

65 Swissgrid (2015) Flexibility Markets. Discussion Paper for a Future Energy Market Design. Laufenburg, February 3, 2015.

by the beginning of 2016 whether a stakeholder meeting will be held, to discuss the main findings and controversial themes. The final conclusions of the consultation are expected to be published by April 2016.

Figure 15: Next Steps of the consultation process

Source: Swissgrid

To participate in the consultation, please use the login details that we have provided. If you haven't received any login details please send us an email to:

consultation.marketdesign@swissgrid.ch

The next steps towards implementation of the proposed measures will depend on the consultation process, and the responses received. These next steps will include more detailed impact assessments, iterations with ElCom and the SFOE, and further stakeholder exchanges.

5.2. Consultation questions

Q 1: Do stakeholders consider the main market design topics addressed by Swissgrid to be appropriate?

Q 2: Are the stakeholders of the opinion that Swissgrid should address additional market design topics besides the three main topic areas of the consultation?

Q 3: Do the stakeholder support the Swissgrid proposal to implement a (near) real-time imbalance price?

Q 4: Do stakeholders see a benefit from formally introducing a new role for an independent aggregator that bundles and markets flexible resources on the wholesale market?

Q 5: Do stakeholders agree with the assessment that a balancing responsibility for renewables would be beneficial? Should Swissgrid implement any other measures to achieve a more efficient integration of renewables?

Q 6: Do the stakeholders support the proposed measures for an optimization of cross-border trading?

Q 7: Do stakeholders propose additional measures that are not mentioned in the consultation document in order to increase the efficiency of cross-border trading?

Q 8: Do the stakeholders agree with the assumption that adequacy responsibility of balance groups in combination with a strengthened price signal will increase market efficiency?

Q 9: Do the stakeholders agree that balancing responsibility should include the prognosis and, if necessary, forward hedging of sufficient resources for end-customer supply?

Q 10: Do the stakeholders consider the proposed hedging products to be appropriate for the hedging of potentially volatile imbalance prices? Are there other proposals?

Glossary

Adequacy: The ability of the electric system to supply the aggregate electrical demand and energy requirements of the end-use customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements.[66]

Ancillary services: All the services which are necessary for the safe operation of the electricity network. These services include system coordination, balance management, primary control, black start and island operation capability of generators, as well as voltage support, including shared reactive energy, and compensation of active power losses.

Ancillary service provider: Market actors that are contracted to provide ancillary services to the TSO. Within ENTSO-E this is usually referred to as a Balancing Service Provider.

Balance group: A balance group is a virtual construct for the purposes of billing and accounting. It covers any number of feed-in and feed-out points. Every distribution grid operator, trader, power producer, supplier and end consumer must belong to a balance group. The balance group manager (BGM) can conduct energy transactions with other balance group managers at home and abroad, offload energy from power stations or transfer energy to end consumers. The BGM is responsible for ensuring that his or her balance group is as balanced as possible at all times. Within ENTSO-E this is usually referred to as a Balance Responsible Party.

Billing unit: Virtual accounting unit consisting of different balance groups that are administrated by the same natural or legal person.

Cost-covering remuneration for feed-in to the electricity grid (CRF): One of the support schemes for renewable energy in Switzerland. Renewables that are subsidized under the CRF currently receive a fixed remuneration for each MWh they produce, independent of market conditions and the quality of their forecasts.

ElCom: ElCom is the independent national regulatory authority in the Swiss electricity sector. It monitors compliance with the national power and energy laws, applies necessary decisions and issues decrees.

ENTSO-E: European Network of Transmission System Operators for Electricity.

Flexibility: Is the capability of a unit to balance rapid changes in renewable generation and forecast errors within a power system. Several options are available to provide flexibility; these can be compared, to calculate the most cost-effective mix of technologies.[67]

66 North American Electric Reliability Corporation (NERC) (2015) Glossary of Terms Used in NERC Reliability Standards. Updated December 3, 2015, p. 5. Available online at: http://www.nerc.com/pa/stand/glossary%20of%20terms/glossary_of_terms.pdf

67 Institute of Energy Economics (EWI) (2012) Flexibility Options in European Electricity Markets in High RES-E Scenarios. Study on behalf of the International Energy Agency (IEA), University of Cologne, Final Report, October 2012, p. 1. Available online at: http://www.ewi.unikoeln.de/fileadmin/user_upload/Publikationen/Studien/Politik_und_Gesellschaft/2012/Flexibility_options_in_the_European_electricity_markets.pdf

Gate closure time: The minimum time period between the nomination of an electricity flow to the TSO and the actual, physical flow of the electricity.

Hedging product: As for insurance contracts, a hedging product protects the buyer against the risk associated with a negative future outcome, such as the risk of being imbalanced at a time when imbalance prices are very high.

Imbalance energy: Quantity of electricity that is required for each billing unit to compensate for the difference between the actual measured withdrawal (or delivery) and the scheduled withdrawal (or delivery), for a given time period, to reach a balanced position of the billing unit within the control zone of Switzerland.

Integrated TSO Market: The Integrated TSO market is a specific type of real-time market, which is currently proposed as a market-based solution for manually activated system service products (tertiary control power, redispatch and possibly other TSO products). This would allow various contracts of the TSO for system balancing and congestion management to be integrated in a single market.

Lead time: The minimum time period between the latest time when electricity can be traded between market participants and the actual, physical flow of electricity.

Loss of load events: Number of hours during which the consumption cannot be satisfied.

Manually activated control energy, or manually activated TSO reserve: Balancing energy which is explicitly accessed by the network operator, as opposed to balancing energy that is automatically accessed through a measurement signal (providing primary control power) or a control signal (providing secondary control power). Manual activations include the provision of tertiary control energy/minute reserves, production changes for redispatch, the retrieval of reserves for other TSO obligations such as the Emergency reserve or MEAS (Mutual Emergency Assistance Service).

Marginal price: The change in the total production cost that arises when the quantity produced is incremented by one unit. In general terms, the marginal price at each level of production describes the additional costs required to produce the next unit.

Post scheduling: Swissgrid provides balance groups with the opportunity to reduce their imbalance through an ex-post, bilateral or multi-lateral netting of imbalances with the opposite direction.

Real-time: Electricity is often purchased several hours or days prior to the delivery period. In this context, real-time describes the time when the electricity which has been purchased in advance will actually be delivered.

Real-time market: Real-time markets open after gate closure. They determine the price for imbalances of balancing groups, based on the supply and demand for balancing energy at the shortest possible lead-time ahead of delivery. In the real-time market, producers act as sellers and the TSO acts as buyer of balancing energy. The TSO procures the

positive or negative balancing energy, which is automatically or manually activated by him. In existing real-time markets, such as the Netherlands, 15-minute products are traded.

Real-time price: Real-time prices are formed by supply and demand in the real-time market. In existing real-time markets, such as the Netherlands, the imbalance price is equivalent to the full marginal cost of the positive and negative balancing energy.

Redispatch: Targeted measures to avoid grid bottlenecks. Based on the result of load flow calculations, TSOs instruct power plant operators in advance to adjust their original production schedule. These adjustments of production schedules are described as redispatch.

Scarcity prices: Refer to market prices that are higher than the marginal price. Price increases above the marginal price are particularly frequent during situations of insufficient supply. We can distinguish market-based scarcity prices, which result if producers exert their market power to raise prices above the marginal cost of production, and administrative scarcity prices, which result if the regulator decides to fix the market prices at a level above the marginal cost of production.

Swiss Federal Office of Energy (SFOE): is a federal agency of the Swiss Confederation. It is responsible for national questions of strategy regarding energy supply and energy use.

Tertiary control reserve: All production capacity which can be automatically or manually inserted for tertiary control, to ensure an adequate secondary control reserve.

TSO market: Markets for ancillary services.

Value of Lost Load (VOLL): The average value of one unit of unserved energy unit for an entire sector or a nation. At this point the VOLL describes the cost of an externality as there is no market to determine the value of supply security.

Volatility: Volatility is a risk measure which describes the intensity of price deviations of an underlying asset from the mean value within a specified period. The higher the volatility, the more prices will reach levels above or below the average, increasing the risk but also the opportunities for an investment in the underlying asset or an investment in the production equipment to manufacture the underlying asset.

Verband Schweizerischer Elektrizitätsunternehmen (VSE): Is the trade association of the Swiss electricity industry. At national level, it represents the interests of approximately 400 members. The association was founded in 1895 and has its headquarters in Aarau. On 1st July 2007, the VSE has merged with the association of the electricity industry in the French-speaking part Switzerland, «Les Electriciens Romands (ER)».

Where available, definitions are based on the Swissgrid glossary:
http://www.strom.ch/fileadmin/user_upload/Dokumente_Bilder_neu/010_Downloads/Branchenempfehlung/swissgrid_Glossar_2010_d.pdf

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