THE ICER CHRONICLE

A FOCUS ON INTERNATIONAL ENERGY REGULATION

EDITION 5, JUNE 2016

The ICER Chronicle

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I. Foreword

Welcome to the 5th edition of the ICER Chronicle.

I first want to express my sincere gratitude for the honor of serving as the new chairman of ICER. Through dialogue and cooperation, we have the opportunity within ICER to carry forward a vision of how regulation can help meet the pressing energy challenges facing our world today. I am committed to this mission, and I want to thank my esteemed colleagues for their confidence and support. I also want to thank our outgoing chairman, Alparslan Bayraktar (Turkey), for his dutiful service to our organization. I also want to thank Lord Mogg (U.K.) for his service and his enduring example of leadership to not only ICER but to regulators around the world.

This latest edition of the Chronicle continues our work to promote the exchange of regulatory research and expertise to contribute to improved regulation globally. This exchange is particularly vital as we seek to evolve our work, including how we apply regulatory principles and knowledge to shifting, uncertain challenges like grid security and climate change. Protecting the grid from attack — cyber or otherwise — and driving adoption of cleaner, more sustainable energy resources are critical tasks for the grid of today and tomorrow, and regulators are well positioned to ensure that emerging approaches reflect sound regulatory values.

The articles included within also explore ongoing evolutions in how we respond to natural disasters and how we seek to ensure consistent and effective enforcement of our regulations. This evolution as well offers the opportunity to examine ourselves – in this edition, authors explore the shift toward evidenced-based regulation and emerging market structures and attributes.

We also once again seek to highlight the stories of women in our field, stories which offer not only inspiration but also illumination of our path toward a more diverse future for energy regulatory bodies. If you have not seen it, I encourage each of you to read our recent special ICER publication on Women in Energy, which was published in March 2016 to celebrate International Women's Day (http://bit.ly/1RXiYyv).

The ICER Chronicle would not be possible without the time, energy and thoughtful review of our editorial board, and I want to express my sincerest appreciation for their efforts to create what you see before you. As always, we welcome your feedback on the Chronicle. Should you have an original article you think would be of interest for future editions of the Chronicle, please submit it to chronicle@icer-regulators.net.

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II. Editorial Board

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Background

In 2013, ICER Virtual Working Group (VWG) 4: Regulatory Best Practices launched the Chronicle as a means to further promote its goals of enhanced exchange of regulatory research and expertise. The ICER Chronicle is published twice a year and selected articles enhance regulatory knowledge around the world. The articles provide a variety of perspectives on different technical topics. It is important to include articles from and of relevance to developing and transitioning economies.

The ICER Chronicle is open to submissions from regulators, academia, industry, consultants and others (such as consumer groups). This ensures a variety of perspectives and increases the exchange of information and messages among the various groups. Submissions will be collected on a rolling basis, in addition to formal Calls for Articles. You are invited to send your article to chronicle@icer-regulators.net.

For past editions of the ICER Chronicle, please visit:

http://www.icer-regulators.net/portal/page/portal/ICER_HOME/publications_press/ICER_Chronicle/Archives

To start a subscription to the ICER Chronicle or for other questions, please email chronicle@icer-regulators.net.

III. Women in Energy: Storytelling

Our WIE section shares stories by women in energy regulatory authorities from around the world. These authentic, personal stories reflect the richness and diversity of our global network of energy regulators. Geographical and cultural boundaries fade when people connect through story telling.

Our two latest stories come from the United States of America (Commissioner Sherina Maye Edwards) and from Spain (Ms Marta García París).

Interested in joining Women in Energy – the ICER International Network?

Connect with regulatory peers from across the globe

Share professional experiences

Benefit from our webinars and mentoring programme

The ICER WIE network is open to all staff (men and women) of ICER's energy regulatory authorities. It's free to join! Visit http://bit.ly/ICERWomenInEnergy

Are you a woman in energy with an inspiring story to share?

Due to repeated requests to widen our WIE story telling, ICER is pleased to open the story telling to all women in the energy sector (both within and beyond energy regulatory authorities).

To share your WIE story, visit the Chronicle section of the ICER website www.icer-regulators.net or contact us at chronicle@icer-regulators.net to learn how to submit your story.

For inspiration, check out the WIE story telling section of the ICER website.

Many thanks to all our storytellers.

Una Shortall

Chair of the ICER Women in Energy Steering Group

Women in Energy
The ICER International Network

Commissioner Sherina Maye Edwards, U.S.A.
Shaping a Powerful Future for Women

When discussing my job as a state regulatory Commissioner with those unfamiliar with the business, I typically explain that regulators balance the interests of utilities, who seek to recover costs for making multi-million dollar investments, with those of consumers, who want safe and reliable service at affordable rates. We are like referees keeping the playing field between utilities and consumers fair by enforcing the "rules" of the game. While this may sound straightforward enough, many of us know the energy industry is anything but simple.

I was appointed to the Illinois Commerce Commission in February of 2013. I am an attorney by trade and, at that time, I had no exposure to or concept of the vastness of the energy industry and what my role as a regulator would entail. I knew that I paid my electric, gas and water bills, but beyond that I had given hardly any thought to the role of utilities in my daily life. I found the learning curve to be quite steep, and was intimidated by the scope and degree of knowledge that so many in the industry seemed to possess. At times it felt like I might never get to a point where discussing—let alone ruling on—these complicated and technical issues came easily. However, I was pleasantly surprised by how quickly I became interested in this subject matter that was so foreign to me. This made it easier to dive head-first into my role as a regulator and, though there will always be new and difficult issues to tackle, I haven't looked back since.

Commissioner Sherina Maye Edwards was appointed to the Illinois Commerce Commission by Governor Pat Quinn in 2013.

Prior to her appointment, Commissioner Edwards practiced law at Locke Lord LLP, an internationally ranked firm. She has taken an interest in electric reliability, water, natural gas and critical infrastructure issues. Through NARUC, Commissioner Edwards serves as Vice-Chair of the Subcommittee on Education and Research and as a member of the Committees on Gas and Utility Marketplace Access, with previous service on the Water Committee.

She earned a B.A. in Psychology from Spelman College and a J.D. from Howard University School of Law.

As a woman of color and the youngest Illinois commissioner ever appointed, it is not always easy to be a leader in an industry with an aging, male dominated and largely non-diverse workforce. Once I was appointed to the ICC, it didn't take me long to discover that my commitment to diversity and inclusion would continuously merit special time and attention. So, in September of 2014, I founded the Women's Energy Summit as an annual forum for select women across the nation to discuss pertinent issues in the energy industry, highlight accomplishments, uplift rising stars, and break down barriers, whether perceived or real, to the promotion and increase of women in the industry.

The success of the first Women's Energy Summit showed me that there was a real need to create a forum where the work of empowering women in the energy industry could take place

on a continual basis as opposed to just at once a year. Shortly after the 2014 Summit, my team set out to find such a forum and learned of the Women's Energy Network (WEN). WEN is an organization of professional women who work across the energy value chain. Its mission is to develop programs to provide networking opportunities and foster career and leadership development of women who work in the energy industries. We learned that while WEN had several chapters throughout the U.S., they had no Midwestern presence. After several months of working with WEN's national team, I co-founded the Chicago chapter of WEN in August of 2015. WEN Chicago has since planned and hosted several events, including networking gatherings, STEM Forums, and professional development workshops.

While it can be challenging and time-consuming to stay on top of my workload as a state regulator, plan the annual Women's Energy Summit, and fulfill my duties as President-Elect of WEN Chicago, the rewards in terms of creating unique spaces for women in this industry to grow, learn and share are immeasurable.

When it comes to unique spaces, many other organizations devoted to the professional development of women in this industry do not have the international component that WIE has. I think that this international element is what sets WIE apart from other industry organizations for women. International experiences are incredibly valuable for professionals at any career level. In May of 2015, through my involvement with the National Association of Regulatory Utility Commissioners (NARUC), and its partnership with the Nigerian Electricity Regulatory Commission (NERC), I traveled to Dubai, UAE, to present at a technical workshop on best practices and approaches in reliability and quality of power. This trip required a great deal of preparation, but ended up being one of the most fulfilling things I've done both personally and professionally as a Commissioner. While NARUC provides a regular space for U.S. regulators to share best practices and discuss industry trends, the international perspectives I gained while in Dubai were unique and unparalleled. I hope that through organizations such as WIE, other women in this industry will be exposed to and take advantage of these types of invaluable international relationships and opportunities.

While there are increasing opportunities and spaces for women, I think the energy industry is still falling short, especially with respect to women in leadership positions. As such, it is important for all organizational cultures to recognize the various demands placed on women both within and outside of the workplace and resist the urge to hold the outside demands against us. While it is difficult for all professionals to balance work and family, women should not disproportionately have to make sacrifices in order to be successful and fulfilled wives, mothers, sisters, daughters, co-workers, supervisors, executive leaders. Career-life balance should not be treated and/or perceived as a zero sum game. It is important for company leaders to remember this in order to retain the best talent across the industry.

In terms of attracting talent, I believe that drawing women into the energy sector begins with making STEM subjects attractive for girls early in their education. Many of the best jobs in our industry require a background in science, technology, engineering and/or mathematics, yet these are not always the subjects that girls and women are drawn to or told that they can excel at when they envision careers for themselves. However, research does show that women are typically drawn to careers where they feel that their work contributes to local, national, and global communities in positive and meaningful ways. It appears to me that there is a pervasive perception problem in that women do not identify STEM careers as those that have these

desired impacts. If we can work to publicize the profound effects STEM and energy careers have on humanity, this would be big step towards not only attracting women to the industry, but also retaining them.

For young women currently finding their way in the energy sector, my advice is to never be complacent and to always think about where you want to be professionally a year, five years, and ten years down the road. All of us should not only constantly set short- and long-term goals, but also strategize as to how we can make our current job, assignments, or projects get us closer to achieving those goals. The key to a successful career is building and maintaining a strong professional network. I often say that your network is your "net worth," and I truly believe this. I have the privilege of working with and among countless knowledgeable and kind people. Nurturing, sustaining and growing these relationships over the years has proven to be a mutually beneficial strategy for me; I gain so much from my network of friends and colleagues and I hope that they, in turn, feel that I add value to their professional endeavors when called upon to do so.

Additionally, it is incredibly important for women leaders to mentor younger women in any industry. I have several mentees and also established an internship program at the Commission where I introduce female law students to the energy industry in the hope that they love it enough to return to it. I'm happy to say that my first intern is now my legal and policy advisor, and my fourth intern is currently working within the ICC's Office of General Counsel. My commitment to mentorship comes from my own good fortune in having several admirable female mentors throughout my career.

As leaders, men also need to advocate for and mentor women with potential. Because there are so many more males in positions of leadership in our industry, men need to do their part to move the needle forward. If capable women aren't being given the attention or grooming they deserve to succeed, excel, and advance, organizations and ultimately our entire industry will lose out on massive amounts of great talent. In other words, it doesn't just make sense to uplift women, it makes dollars.

From grid modernization efforts to countless technological innovations changing the way we consume, generate and store energy, it's certainly an exciting time to be a professional in the utility space. While there is always room for more visibility, women have undoubtedly made their mark on the energy industry worldwide. I am beyond confident that women will continue to achieve great things, attain leadership positions, and add incalculable value to the electrifying changes coming down the industry pipeline.

Women in Energy
The ICER International Network

Marta García París, Spain

The Power of Women

Marta works in Ecoserveis, a non-profit organization based in Barcelona (Spain). She works as a project manager and her field of expertise is mainly the relation between energy and consumers. Marta also works as an energy teacher at Open University of Catalonia.

We have just weighed anchor from a big seaport in a cargo liner, a vessel called "World." Passengers on board are distributed in classes. Almost 250 of the 1.000 total passengers don't have access to electricity and about 40% of all the travelers rely only on solid biomass for cooking and heating. Which is the purpose of travelling in this cargo liner? And what about energy? How essential is energy in our journey?

I am travelling in first class where half of the passengers are women. Next to me, an 18-year-old girl looks fixedly to the book I am reading: Energy Autonomy from Hermann Scheer.

Her shyness didn't stop her from introducing herself: *Hi, my name is Wang Xiu Ying and I am from China. Sorry for interfere in your reading, but I was just curious about it. I have just read in your book that for 200 years industrial civilization has relied on the combustion of abundant and cheap carbon fuels…but continued reliance has had perilous consequences. My father works in a coal mining company, well, in fact most part of my family does as my three brothers work there too. We have always seen coal as the black gold and thanks to that my family has been able to provide me with higher education. Do you know what? This journey is the start of my new life as I am about to start my university degree in medicine. I will be the first member in my family having the chance to go to university and I am so excited!*

I was surprised for the self-confidence and the energy of the words of my new travel mate, and I remember we started an interesting conversation.

Congratulations for your new challenge Wang Xiu Ying! You will be a great Doctor -- I replied. *I am sorry if reading those words have hurt you, but energy is a complex issue and things are never black or white. Energy is a strategic sector, as we cannot do without it. However, nowadays, even if it is the lack of access to electricity, the inability to afford energy bills or the multiple administrative, political, economic or educational barriers, the reality is that our world lives in energy poverty. I am reading this book as I work in the field of energy education. I studied to become an expert on renewable energies but then, I realized that energy was a wider and a more complex business than I expected. I could verify that technologies existed and that the problem was that they were ineffective as users were not convinced to use them. This is why I started to focus my career in educating in energy at different levels. Coal is strategic in China as it is in many other countries, but it use should not compromise future generations and health and environmental problems derived from coal burning should be taken into account too.*

We continued the conversation hours and hours. Wang Xiu Ying was really interested in energy use in China and I was absorbed on her story about her battle to make her dream come true and overcome multiple barriers just from being a woman. I understood then that, after all, we were not so distant as we were both beating obstacles to get a better future, to reach a better world.

We, these two women, are in the same cargo liner, and together we have the power to lead it where we decide. The question then is… where are we heading to?

IV. Spotlight on Smart and Strong Electric Power Infrastructure: Best Practice Shared from ISGAN Annex 6 Case Book

Susanne Ackeby and Bo Normark

Introduction

The introduction in the generation mix of a continuously increasing share of generation from renewable energy sources (RES), the geographical spread of generation when increasing the amount of distributed production, as well as changing patterns of demand from new types of load such as electric vehicles, will create new challenges for the electric power transmission and distribution (T&D) systems.

Many different approaches are possible to meet these challenges and the regulators have a key role in supporting the development towards clean sustainable solutions.

Different countries have different challenges, will use different solutions to those challenges, and have reached different maturity in the implementation of those solutions. Smart grid solutions are also found across the entire electrical system, from the high voltage transmission grid, through the distribution grid and finally on consumer level. It is therefore no generic solution or size that fits all for the solution towards the smart and strong grid. At the same time there are generic solutions and findings from experiences that can be adapted by other countries to make local implementation faster and more efficient.

ISGAN (International Smart Grid Action Network) Annex 6: Power T&D Systems has therefore in 2015 published a T&D Case Book called "*Spotlight on Smart and Strong Power T&D Infrastructure*" where the member community has contributed with specific projects to illustrate applications, solutions and technology from different countries and from different levels in the electrical system (http://www.iea-isgan.org/index.php?r=home&c=5/378).

Figure 1: The ISGAN Annex 6 T&D Case Book

This paper is based on the T&D Case Book, an article based on the same published at the India Smart Grid Week 2015, and other work done by ISGAN Annex 6: Power T&D Systems.

To provide the real-time flexibility needed to efficiently handle the new operating conditions of the power grid and at the same time secure stability, security of supply and quality of service, the T&D system has to become smarter and stronger. This requires different types of improvements throughout the system.

Controllable devices based on power electronics

Smart transmission technologies are traditionally based on power electronics. With power electronics it is possible to build controllable transmission systems such as flexible AC transmission systems (FACTS) and high voltage direct current (HVDC). These technologies are continuously being developed towards even higher controllability with the introduction of new generation of power semiconductors. The most recent HVDC technology VSC-HVDC allows long underground subsea or underground cables and also offers new system services.

The Irish transmission system operator (TSO), Eirgrid, shares a case in the case book where they have improved the security of supply in their network by providing additional capacity. This was done by building the East-West Interconnector (EWIC), using the latest semiconductor technology, a voltage source converter (VSC)-HVDC based link, which connects the electricity transmission grids of Ireland and Great Britain. The interconnector has a capacity of 500 MW (equivalent to approximately 10% of the Irish peak demand) and also provides a range of smart solutions including:

- ancillary services such as
    - frequency response
    - reactive power provision
- 'black start' capability for both Ireland and Great Britain.

The project is instrumental for Ireland to reach its renewable electricity targets but also greatly contributes to lowering the electricity price for consumers.

The Swedish TSO is building a link (South West Link) also using the VSC-HVDC technology to increase the reliability and improve security of supply to the south of Sweden. Increasing the capacity to the southern part of Sweden became especially important after the decommissioning of a nuclear power plant which led to increased capacity limitations related to voltage instability. The link is thus important for developing the network to allow the increased penetration of renewable energy as planned. The transmission system was basically using existing right-of-way for overhead lines and underground cables in virgin land. This was only possible by using the new VSC Technology.

Both the Swedish and the Irish systems represents new technology with higher performance but also a technology risk. There were no particular regulatory incentives to stimulate the use of new technology. Such regulation could be needed to share the risk with new technology.

Increased system knowledge and supervision

Another element to reach a strong and smart grid is to increase knowledge and supervision of system behavior and wide area implementation of information and communication technology (ICT) for monitoring, protection, control, automation and visualization.

New regulation providing penalties for outages and improved statistics of grid reliability has stimulated the use of more advanced monitoring, measurement and control systems for the grid.

Smart solutions will generally increase the utilization of existing assets and this is generally not rewarded in current regulatory regimes that mainly are focusing on penalties than rewards.

Both the United States and Italy share cases where wide area management systems (WAMS) and phase measurement units (PMUs) are integrated into their networks.

The project presented in the U.S. case provides grid operators and reliability coordinators with more frequent and time-synchronized system information. Better system visibility will help system operators avoid large-scale regional outages, better utilize existing system capacity, and enable greater utilization of intermittent renewable generation resources. The synchrophasor-based controls will use wide-area synchronized measurements to determine voltage stability risks and will initiate corrective actions in less than one second. Also real-time analytical applications are in use in the control centre together with operational displays. Another important benefit of the project is that the collected data is used to validate the system models leading to more accurate models, which is essential for reliable and economical grid planning and operation.

Improved understanding of power grid performance leads to possibilities to optimize the capital investment. It is also expected that the synchrophasor data will lead to large-scale outage avoidance and early detection of equipment problems.

In Italy, functions have been developed for oscillatory stability analysis, network separation detection, load shedding intervention evaluation and line thermal estimation. Real-time plots and charts of system quantities such as phase angle differences, and the output of monitoring functions such as oscillation identification, allow operators to better track system stress and dynamic phenomena, and evaluate the possible impact of switching actions. Cooperation with other countries of the same synchronous area, in the form of real time PMU data exchange, has proven being particularly useful.

Another possibility to improve the network operation based on increased information is the “Situational Awareness System” that is being implemented in South Africa.

The idea with situational awareness is to combine the electrical interconnected power system with environmental conditions and by doing so being able to more accurately anticipate future problems to enable effective mitigation actions. Grid situational awareness provides real time support for decision making based on real-time event management, forecasting, power stability and management through dynamic system sources.

France presents a case based on an industrial pilot project that aims to design, build, test and operate two fully digital smart substations. The project includes experimentation of a new technological package including new advanced control functionalities.

The intention with the project is to enable the electrical power equipment to work closer to their physical limits. And it will assess the benefits provided by solutions such as a lower environmental impact, better integration of the renewable energy sources, improved transmission capacities, and optimal use of the existing assets.

The new technique can offer a more cost efficient way of utilize the grid. Interoperability standards are required for this development and incentives from regulators can speed up this process.

Control in the Distribution Network

Solutions could be implemented at all different levels of the energy system.

The Austrian case presents solutions for low or medium voltage networks. The main goal of the Austrian project is to find an efficient way for the integration of renewable electricity production with regard to optimized investment by maximizing the utilization of the existing asset base.

The main challenge of integrating distributed energy resources (DER) in rural distribution networks, as pointed out in the case book, is to keep the voltage within the specified limits, which the project aims at doing through the use of smart planning, smart monitoring and smart control. The project demonstrated that different voltage control concepts made it possible to increase the possibility for integrating more renewables significantly.

Customer interaction

There is also a new role for customers when time-dependent electricity prices, local generation, as well as grid-side energy storage, all become increasingly feasible.

The second Italian case describes their experience of introducing time-of-use tariffs and the effects of such tariffs on electricity consumption by residential customers in Italy. The long-term goal is to induce the Italian customers to adjust their consumption according to the abundance or scarcity of electricity leading to a smoother load profile. This will for example lead to less need of reinforcements in the network due to a reduction of the load during peak hours.

The results show that, even if there was a limited shift of consumption from peak hours to off-peak hours in the period following the introduction of the mandatory ToU tariff, the change in the behaviour of the users is not negligible.

An holistic approach to achieve a cost effective transition

A holistic view across system planning, investment, and operation is needed to create a power grid capable of integrating the actions of all actors — including new market players — while maximizing the benefits and limiting costs.

Smarter and stronger grids will require investment at all levels of the grid. Priority investment should be targeted where the deployment of new technologies will immediately improve system operation and promote clean energy deployment. This calls for the introduction of both power electronics and ICT technologies to increase grid flexibility and to provide knowledge and control capabilities of system behaviour. Furthermore, as they are at the centre of power systems, interaction and coordination between grid operators at all levels and across regions should be enhanced to minimize cost and secure system stability.

Important issues for policy makers to focus on

The collective learning has resulted in some key issues that the policy makers should focus on:

1. The adoption of interoperability standards to accelerate technology deployment and innovation
    a. Local or national standards should be aligned with internationally developed “future proof” standards in order to drive both deployment of available technologies and ongoing innovation.
    b. Technical and financial know-how is a key element for making the policy and interoperability decisions. Policy education has to be provided and international expertise exchange should be leveraged to advance international cooperation.
2. Implement stable financial support regimes and clear regulations

a. Governments and regulators should share the risk in investment decisions with stable financial support regimes for new technology and business model deployment.
b. Transparent and well communicated cost-benefit analyses are crucial for clear regulations and stable financial support regimes and increase public acceptance.

3. Support simplification of permitting procedures regarding implementation of necessary grid infrastructure
4. Roles and regulations must be developed in parallel with changing markets and actors
    a. The cooperation of utilities should be encouraged to align procedures, implemented technologies, standards and long term planning.
    b. The necessary information exchange between Smart Grid actors has to be identified and assured in order to manage the system in the most efficient way and to secure system stability.

ISGAN

ISGAN, International Smart Grid Action Network, is a mechanism for international cooperation with a vision to *"**accelerate** progress on key aspects of smart grid policy, technology, and investment through voluntary participation by governments and their designees in specific projects and programs."* It is a multilateral government-to-government collaboration to advance the development and deployment of smarter electric grid technologies, practices, and systems.

ISGAN has to date 25 members: 24 countries from five continents and the European Union.

Figure 2: The ISGAN members

ISGAN aims to improve the understanding of smart grid technologies, practices, and systems and to promote adoption of related enabling government policies. ISGAN activities center on those aspects of the smart grid where governments have regulatory authority, expertise, convening power, or other leverage, focusing on five principal areas:

Policy, Standards and Regulation

Effective policies and efficient regulation are critical to the development and deployment of Smart Grid technologies, practices and systems. Sharing information on policies and regulations developed by a country and associated lessons learned; harmonizing specific policies regarding developing and implementing smart grid inter-operability standards; and developing toolkits for

policymakers for policy implementation at the national, sub-national and local levels may accelerate overall progress on smart grids.

Finance and Business Models
Implementing Smart Grid technologies will likely require new business models and financing mechanisms beyond simple rate recovery. Thus, an objective is to share information and experiences on novel government and private-sector models to support deployment of smart grid systems.

Technology and Systems Development
Cooperative research, development and demonstration of pre-competitive Smart Grid technologies using consistent methodologies and testing protocols will advance the state-of-the-art of the industry and allow for more rapid deployment of Smart Grids. Activities may include cataloguing existing RD&D efforts and coordinating laboratory or test bed networks.

User and Consumer Engagement
The full benefits offered by smart grids will be achievable only with the involvement of stakeholders along the full spectrum of the electricity system, from power generation through power transmission and distribution, and ultimately to end-use by consumers. This area involves understanding how best to engage these many stakeholders to educate them on the purpose, benefits, and use of smart grids.

Workforce Skills and Knowledge
Implementation of new Smart Grid technologies and approaches to energy and information will require training not only of utility and power industry personnel directly involved with electricity production, transmission, and distribution, but also regulatory staff, information technology and cyber security specialists, and others who will need deep understanding of this complex and potentially transformational suite of technologies, practices, and systems.

The International Smart Grid Action Network (ISGAN) was launched at the first Clean Energy Ministerial (CEM), a meeting of government ministers and stakeholders from 23 countries and the European Union which was held in Washington, D.C in July 2010. In April 2011, ISGAN was formally established as the technology Collaboration Programme within the International Energy Agency (IEA) for a Co-operative Programme on Smart Grids (ISGAN), operating under the IEA Framework for International Energy Technology Co-operation. Membership in ISGAN is voluntary.

ISGAN is managed by its Executive Committee, which meets twice a year, and supported by a Secretariat at the Korea Smart Grid Institute. Within the ISGAN, a Chair and three Vice Chairs serve the ISGAN in a close collaboration with the Secretariat.

Further information can be found at the ISGAN website (http://www.iea-isgan.org/).

Additional reading

ISGAN Insights Publications can be downloaded at this address: http://www.iea-isgan.org/index.php?r=home&c=5/378. Some of the available materials are listed below.

Published discussion papers by ISGAN Annex 6: Power T&D Systems

TSO-DSO Interaction - An Overview of current interaction between transmission and distribution system operators and an assessment of their cooperation in Smart Grids.

FLEXIBLE POWER DELIVERY SYSTEMS - An Overview of Policies and Regulations and Expansion Planning and Market Analysis for the United States and Europe

Smarter & Stronger Power Transmission -Review of feasible technologies for enhanced capacity and flexibility

Case Books

Spotlight on Smart and Strong Power T&D Infrastructure

Spotlight on Advanced Metering Infrastructure

Spotlight on Demand Side Management

Other

Smart Grid Project Catalogue part 1

Smart Grid Project Catalogue part 2

The Role of Smart Grids in Integrating Renewable Energy

Smart Grid Drivers and Technologies by Country, Economies and Continents

Bo Normark, the chair of ISGAN Annex 6, is a member of the Swedish Royal Academy of Engineering Sciences. He is also a board member of the Swedish National Grid Company, the Swedish Transmission System Operator (TSO). Normark is a Senior consultant to KIC InnoEnergy.

Previously Normark worked for ABB in power transmission equipment including advanced smart transmission grid technologies such as High Voltage DC (HVDC), Flexible AC Transmission (FACTS) and High Voltage Cables.

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V. Electric and Gas Utility Service Reliability

Upendra J. Chivukula

The objective of the paper is to present a few ideas about the importance of the electric and gas utility service reliability requirements that a Public Utility Commission (PUC) can establish in its respective state as uniform statewide reliability standards for electric and gas public utilities.

After Hurricane Sandy wreaked havoc with energy supply in the Northeastern United States, many consumers and public officials complained that the electric utilities had done far too little to protect their equipment from violent storms, even though forecasters had warned violent storms could strike with increasing frequency. It seems from a utility's perspective, it is typically far cheaper for the company, and its customers, to skip the prevention measures and just clean up the mess afterward.

In the utility sector, there is an increasing need for more proactive discussions among appropriate state government agencies, regional entities, and electric and gas public utilities about how to work together to ensure electric and gas service reliability. There is also a need for increased certainty and greater flexibility to preserve electric and gas service reliability and to mitigate additional rate increases through the timely maintenance of the electric and gas utility network infrastructure.

We know that reliable electricity and natural gas utility service is essential to the health, welfare, and safety of the American people and necessary for our economy. In order for state agencies to make appropriate regulatory decisions affecting the electric and gas public utility industry and consumers, they require enough information.

As policymakers continue to consider the complex risks from natural disasters, terrorism, aging infrastructure, and climate change, increasing attention needs to be focused on reliability, resilience, or both. To improve energy infrastructure's reliability/resilience, better use of metrics will be crucial for planning and evaluating progress. We can agree that the adoption of uniform Statewide standards of acceptable performance, in the areas of service reliability and restoration of service, by electric and gas public utilities doing business in the State will help minimize health and safety problems occurring due to utility service hazards or disruptions. The PUC needs to establish uniform reliability, safety, and service quality standards for electric power and natural gas suppliers to promulgate and to resolve complaints regarding the quality of electric generation service and gas distribution.

Reliability is often thought of as the consistency in performance and availability of the utility service. Reliability assures that a system will perform for the required duration within a given environment. Reliability is the outcome for which service providers strive for, specifically, the availability. Recently, because of the several storms affecting availability, resilience is talked about a lot. Resiliency is the ability of a service to withstand certain types of failure and yet remain functional from the customer perspective. The terms reliability and resilience are often interchangeably used. But, some people might contend that reliability is the outcome and resilience is the way you achieve the outcome. A service could be characterized as reliable, simply because no part of the service has ever failed, and yet the service couldn't be regarded as resilient because those reliability-enhancing capabilities may never have been tested.

For the purpose of this paper, the following definitions are used:

“Disruption of service” means the loss of service within the service territory of a public utility according to criteria to be established by the public services commission (PUC). “Disruption of service” shall not include events that are planned, or occur as a conservation or safety measure, or any other event that results from the routine and prudent operation of the public utility transmission or distribution system.

"Public utility" means a utility under the jurisdiction of the PUC, is investor-owned, and transmits and distributes either electricity or natural gas to end users within this State.

“Bulk power system” means all Transmission Elements operated at 100 kV or higher and Real Power and Reactive Power resources connected at 100 kV or higher and does not include facilities used in the local distribution of electric energy.

“Energy reliability” means a reliance on energy that is generated from consistent electrical output and meets expected peaks in energy demand.

“Energy resilience” means ensuring energy robustness in the electric public utility’s infrastructure and operations in order to avoid or minimize interruptions of service during disruptive events. Resilience of energy systems can be measured by many outcomes, such as reduced damage from disasters, increased economic activity, or reduced deaths and injuries from disasters.

It is important that the PUC needs to be authorized by the legislature to establish uniform State-wide standards of acceptable performance for service reliability and restoration of service for public utilities that is consistent with the federal law. These standards often may replicate national standards for service reliability and restoration concerning the transmission of electricity and natural gas and include, but are not limited to, appropriate standards adopted by the North American Electric Reliability Corporation, the Federal Energy Regulatory Commission, the Office of Pipeline Safety, Pipeline and Hazardous Materials Safety Administration, and the United States Department of Transportation. These standards may be subject to adjustment, as appropriate, to electricity and natural gas distribution service and to accommodate any factors unique to the State.

The uniform State-wide standards need to address the following components of utility service:

- Electric power and natural gas supply resource and demand balancing, flow monitoring, and stabilization
- Critical infrastructure protection and control
- Communications coordination
- Emergency preparedness and operations
- Facilities design and operations maintenance
- Personnel performance, training, and qualifications requirements
- Electric power and natural gas system disturbance, contingency response, and system restoration
- Reliability operating limits coordination.

Resilience describes the state of service being provided by a system in response to a disruption. When assessing resilience, key questions would be whether the service has been degraded, how much of the service has been degraded, how quickly the service has been restored, and how completely the service has been restored. Therefore, resilience does not

describe a dichotomous state of whether or not a disruption has occurred. Rather, resilience describes the degree of disruption across multiple dimensions, which could include type, quality, time, and geography of service provision.

One of the proposals is to require each public utility conducting business in the state to annually submit to the PUC, a service reliability plan for review and approval. The service reliability plan should be required towards the provision of safe and reliable service and the reasonably prompt restoration of service in the event of a widespread disruption in the service area of the public utility due to storms or other causes beyond the control of the public utility. The provisions of the plan should reflect the standards described earlier.

After review of a public utility's service reliability plan, the PUC may request that the public utility amend the plan. If the PUC finds a material deficiency in the plan, the PUC may order the public utility to make any modifications as it deems reasonably necessary to remedy the deficiency.

The PUC needs to have the authority to open an investigation to review the performance of any public utility in restoring service during a widespread disruption of service in the public utility's service area. If the length of the disruptions of service were materially longer than they would have been but for the public utility's failure, the PUC may need to conduct evidentiary hearings or other investigatory proceedings. If the PUC finds that as a result of the failure of the public utility to implement its service reliability plan submitted by the public utility and approved by the PUC, the PUC may need to impose a civil administrative penalty. The PUC should not be able to impose a penalty related to a service reliability plan that has not been formally approved.

The reliability plan needs to meet all reliability standards established by the North American Electric Reliability Council or its successor, the Independent System Operator (ISO) or its successor, the Federal Energy Regulatory Commission (FERC), the PUC, or any other state, regional, federal or industry body with authority to establish reliability standards. The PUC may establish specific standards applicable to electric power suppliers to ensure the adequacy of electric power capacity if it determines that standards established by any other state, regional, federal or industry bodies are not sufficient to assure the provision of safe, adequate, proper and reliable electric generation service to retail customers in the State. Such reliability standards will ensure bulk power system operations and security, and also will ensure the adequacy of electric power capacity necessary to meet retail loads.

Each public utility conducting business in the state would be required to submit an emergency communications strategic plan annually for review and approval by the PUC. The communications strategic plan needs to be reviewed in consultation with the State Office of Emergency Management. The strategic plan needs to include, but not be limited to, an explanation of the public utility's system for communicating with customers during and after an emergency that extends beyond normal business hours and also the designation of public utility staff to communicate with local officials and relevant regulatory agencies.

After review of a public utility's emergency communications strategic plan, the PUC may request that the public utility amend the plan. If the PUC finds a material deficiency in the plan, the PUC may order the public utility to make any modifications as it deems reasonably necessary to remedy the deficiency.

The PUC needs to undertake a detailed study of electric and gas utility service reliability and its impact on electricity and natural gas prices, economic activity, the number of jobs created to

maintain service reliability, and the reliability of electric and natural gas service in the state. The law needs to require that within three years of the effective date of the legislation, the PUC to prepare a report of its study and provide a copy to the Governor and to the Legislature.

Upendra J. Chivukula was nominated by Governor Christopher J. Christie as a Commissioner to the N.J. Board of Public Utilities on September 18, 2014 and confirmed by the Senate on September 22, 2014

Prior to his nomination, Upendra served in the NJ Assembly, where he served as chair of the Assembly Telecommunications and Utilities Committee; Vice Chair of Homeland Security and State Preparedness, Commerce and Economic Development, and Environment and Solid Waste. He was noted for being a strongly progressive legislator. Upendra was a 3-term Deputy Speaker of the New Jersey General Assembly.

VI. The Quantum Model: a Framework to Enforce Regulation and to Promote the Quality of Public Services

Issao Hirata, Breno de Souza França, Camilla de Andrade Gonçalves Fernandes and Alessandro D´Afonseca Cantarino

I. INTRODUCTION

One of the major objectives for any regulator is to ensure regulatory compliance, which is essential to the proper function of any regulated market. For public service regulators, such as energy or telecommunications, effective enforcement is also a key tool to ensure quality of services and to promote a flourishing market.

Traditionally, a lot of effort has been put on how regulations should be modeled. Most countries are already spending resources in regulatory impact analysis and assessing regulatory options when designing new regulations. However not much attention has been given on how those regulations should be implemented and enforced.

Fortunately, regulators are now realizing that regulatory enforcement is an important element on regulatory policy and that modern enforcement techniques are essential to achieve the goals intended when the regulations were designed.

Recently, a few publications have focused on this topic. For instance, OECD has published a work on the best practices for regulatory inspections and created a set of 11 principles that any regulator should observe when promoting inspection and enforcement reforms, which are listed below:

- Evidence-based enforcement
- Selectivity
- Risk-Focus and Proportionality
- Responsive Regulation
- Long-Term Vision
- Co-ordination and consolidation
- Transparence Governance
- Information Integration
- Clear and Fair Process
- Compliance Promotion
- Professionalism

Those principles aim to serve as a guideline to implement effective and efficient enforcement reforms in order to maximize regulatory compliance and minimize the needed resources and costs.

This article aims to present a framework that adopts those principles and that can be used to implement enforcement reforms. Although the model was designed for enforcing regulations on electrical energy generation in Brazil, it can be easily adapted for other regulators and for other fields. In this article, references with the OCDE principles will be made along with the model description.

This framework, named Quantum Model, organizes the enforcement activities in three different levels: **surveillance**, **investigation** (**office actions**) and **field inspection**. The idea of organizing the enforcement activities in different levels is to objectively implement the concept of "***Responsive Regulation***" in the framework. A more detailed description about the model will be presented in the following chapters.

In other words, the idea is to relate the intensity and complexity of the enforcement actions to the behavior and performance of the regulated agents. Companies that are "doing the right thing" will be less likely to be object to deeper investigations or field inspections.

II. ENERGY GENERATION IN BRAZIL

The Quantum model has been initially designed to promote reforms on Electrical Energy Generation inspections and enforcement activities in Brazil. A brief summary about energy generation in Brazil and the role of its regulatory agent will be described in this chapter to help the reader to better understand the examples that will be shown in the following chapters.

Brazil has the largest electricity marked in South America and has around 141 GW of installed capacity. Most of the energy produced in Brazil comes from hydropower generators (accounting for the 65% of the energy generated in 2014). Other renewable sources are also significant, for instance biomass (accounted for 7% of the generated energy in 2014) and the fast growing wind power plants. Non-renewable sources also play an important role, especially when the country faces long periods of droughts, such as the one observed in the last couple of years.

Energy generation in Brazil is a regulated market and energy generators are object to oversight by the regulator. ANEEL (Brazilian Electricity Regulatory Agency) is the electrical energy regulator in Brazil and SFG (Superintendence of Energy Generation Services Oversight) is the Superintendence inside ANEEL responsible for the enforcement and compliance activities over energy generators.

Although in most countries energy generation oversight is usually not the object of close attention from regulators, this is not the case for Brazil. Due to characteristics of the Brazilian model, enforcing regulatory compliance on generators is essential to ensure the quality of service and to promote the expansion of the installed capacity, which is a key issue for energy security in any emerging country.

The key objective of SFG/ANEEL consists of assuring that the needed amount of energy can be safely delivered at the right time. For that, a set of different enforcement action types are taken by the Superintendence on the generators. Some of those action types are listed below:

- Performance of operating power plants
- Construction Progress of new power plants
- Performance on Black Start tests
- Dam safety on hydropower plants
- Integrated system energy operations
- Peak demand management

In relation to the universe of energy generators that are object to oversight and enforcement activities, there are more than 4000 operational power plants and more than 800 plants under construction spread all over the country. They vary in age, technology and size (from less than 1 MW to more than 11000 MW). Also, the logistic to reach those installations is complex, so field inspections are very time (and resource) consuming for the regulator.

Thus, it is clear that the regulator should act in a smart way, adopting ***selectivity, risk-focus and prioritization*** on its actions. These aspects, along with the other principles listed by OCDE were incorporated into the framework that will be explained below.

III. THE QUANTUM MODEL

The Quantum Model is a compliance and enforcement model that was developed in order to reform and redesign all the oversight activities performed by SFG/ANEEL. Basically, the model consists of three different levels of activities: **surveillance**, **investigation** (office actions) and **field inspection**. A simple representation of the model is shown in Figure 1.

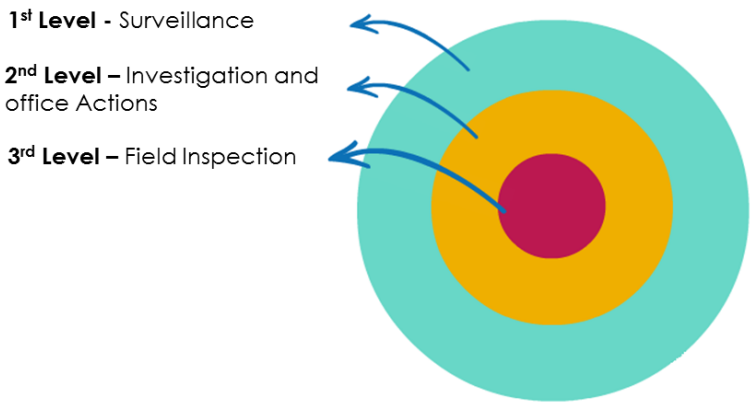

Fig. 1 – Quantum Model of 3 Level Enforcement

A more detailed representation of the Quantum Model of 3 Level Enforcement steps and activities is shown on the Flow Chart in Figure 2.

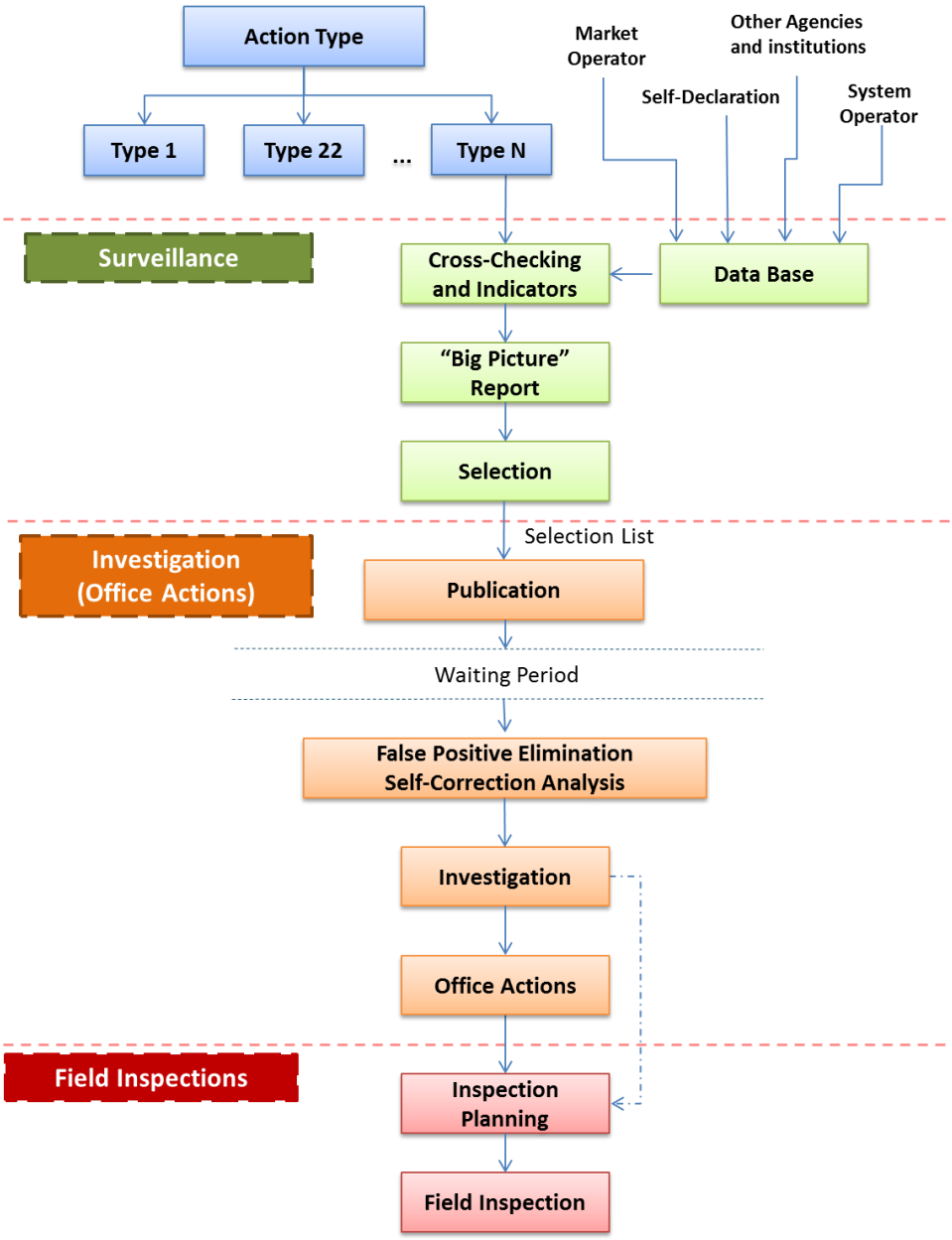

Fig. 2 – Quantum Model Steps and Activities Flow Chart

The first level, Surveillance, has the broadest universe of agents being analyzed. It includes information about every regulated agent and installation. The main idea is to run an automated risk analysis by applying analytical intelligence to filter the potential risks or problems ***(risk focus and proportionality)***.

For this reason, it is essential that data and information are properly organized, structured and updated. The data being used on the Surveillance Level can originate from different sources such as: from the agent itself (self-declaration forms), other institutions such as the ISO (Interconnected System Operator), the Market Operator and other regulators. The data from those different sources are then organized, crossed and stored in a Database ***(information integration)***.

The idea is to use this data to extract information and indicators about the agents to run an automated risk assessment analysis by searching for evidence (***evidence based***) to select companies or installations (***selectivity***) with unwanted behavior, poor performance or potential risk.

As an example of analysis being performed at this level, we are using self-declaration and historical data from power plants under construction to identify cases when the construction is behind schedule and that can impact energy security or that can offer risk of energy shortages in the future.

Furthermore, besides providing an analytical method for risk assessment, the surveillance level also enables the regulator to understand the "Big Picture" about the market performance on a pre-defined topic or analysis. For example: How is the general performance of Wind Generators in the Country?

Once the Surveillance is executed and a list of installations (or companies) with potential problems is generated, the activities of the Next Level (Investigation and Office Actions) begin. The main objective of the second level is to execute a detailed investigation for every case filtered during the Surveillance level.

While the keyword during the Surveillance Level is **analytical intelligence**, the keyword for the Investigation and Office Actions Level is **qualitative intelligence**. In other words, the activities on this level will be highly dependent on the auditors experience and knowledge.

The first step of the Investigation and Office Actions Level is to publish (or inform) the agents about the results obtained in the Surveillance Level (***Transparence***). The objective is to let the agents know how they are "seen" by the regulator and use this instrument to help them understand what they are expected to do (in terms of behavior and performance) to become fully compliant (***Compliance Promotion***).

Besides, by publishing those results the idea is to give to agents with minor irregularities (with no or low impact to the customers) an opportunity for self-correction without starting a formal investigation process, saving the regulator's resources.

Also, it is important to notice that False Positive cases are expected to happen, since the risk assessment performed during the Surveillance Level is quantitative and does not include "Human Intelligence".

In both cases (False Positives and Self-Correction of minor irregularities), the investigations are closed (eventually they don´t even start formally), which means that resources are not spent on a deeper investigation and there is no need for a penalty to be applied.

However, for the other cases (True Positives and relevant irregularities) a detailed study and investigation will be performed. This investigation includes not only the information and indicators used on the previous level (Surveillance) but also relies on documental analysis, meetings and information exchange with the regulated agent.

A lot of effort is currently being put on the development of investigation tools and procedures to ensure that investigations are performed consistently and uniformly (***professionalism***).

If the investigation conducted in the office has enough evidence to confirm the existence of an irregularity, a notification can be issued without the need for a field inspection. After being notified, the agent has the opportunity to reply (or appeal) before an eventual penalty is issued.

Since some investigations are rather technical, there are cases when it will not be possible to collect all of the needed evidence without performing a field inspection. Then, the activities of the third level (Field Inspection) start.

Prior to the Field Inspection itself, a lot of resources were already invested during the investigation level. This information will be used by the inspector to help him better understand the potential problems. Before the inspection, a focused inspection plan has to be developed in order to define what evidence needs to be collected and which questions need to be answered during the field inspection.

Traditionally, regulators tend to make use of field inspections to understand “what is going on”. This is not the approach we are applying for the Quantum Model. Since prior investigations were already performed, the inspector already knows which problems are (potentially) happening on site. Thus, the objective of a field inspection is to collect more evidence, to understand why that problem is happening and to verify if there is any irregularity cause by mismanagement.

If the field inspection concludes (or confirms) the existence of the irregularities, a notification is issued. After giving the agent the opportunity to reply (and appeal) a decision is taken either to punish or to make recommendations to the agent.

IV. RESULTS AND EXPECTATIONS

The Quantum model is a compliance and enforcement framework that is being used to reform and redesign all the activities performed by SFG/ANEEL to oversee and enforce regulation on power plants and energy generators in Brazil.

Although much of the reforms are still in progress, some results have already been obtained. The Quantum Model was applied and tested for a few enforcement actions, for instance it was used to oversee the operational performance of the biggest hydro power plants in Brazil.

In this case, the Surveillance step analyzed and crosschecked information on 138 hydro power plants. As a result, 55 were classified as compliant, 47 as partially compliant and 36 as non-compliant in terms of general operational performance.

The tools and procedures that allow the auditors to perform a detailed investigation for each one of those 36 power plants were developed and are currently being applied. Also, the procedure on how to run field inspections and how to act in order to collect evidence for different scenarios and situations were also developed.

The results obtained so far are promising, not only on the example mentioned above, but also in other activities that were already redesigned. It is clear that the framework, which incorporated many of the OCDE principles, provides an efficient way to implement the needed reforms.

Finally, by implementing such reforms, we aim to turn enforcement actions into a tool to promote modifications on undesirable behavior, to ensure regulatory compliance. Ultimately, our ***long-term vision*** is to improve the quality of services provided by energy generators in Brazil.

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From L to R: Issao Hirata, Breno de Souza França, Camilla de Andrade Gonçalves Fernandes, and Alessandro D´Afonseca Cantarino

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VII. The Effect of the NERC CIP Standards on the Reliability of the North American Bulk Electric System

Marlene Z. Ladendorff, Ph.D

Considerable money and effort has been expended by generation, transmission, and distribution entities in North America to implement the North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) standards for the bulk electric system.

Assumptions have been made that as a result of the implementation of the standards, the grid is more cyber secure than it was pre-NERC CIP, but are there data supporting these claims, or only speculation? Has the implementation of the standards had an effect on the grid? Developing a research study to address these and other questions provided surprising results.

The Academic Perspective

Studying the effect of the NERC CIP standards on the reliability of the electrical grid first appeared a daunting task for a PhD dissertation. Becoming immersed in the topic, however, quickly revealed abundant opinions about grid reliability and CIP standards, but little data or facts from which to develop a quantitative study. A literature review on the topic revealed a lack of formal structured research. Based on these findings, a qualitative research methodology was indicated in order to begin studying grid reliability changes as a result of NERC CIP implementation from an academic perspective. A qualitative study design suggested that it would likely be possible to tackle this topic within a reasonable time frame.

The Industry Perspective

The NERC CIP standards have understandably been the root of much debate in the electricity industry. Implementation has not been cheap for entities, requirements have sometimes been unclear, and the implementation effort to achieve compliance (sufficient to pass an audit) has not been trivial. Determining how the CIPs have affected the reliability of the grid may potentially have an impact on future revisions of the standards as well as new standards that are under development. The data gathered in this qualitative study, via interviews with Subject Matter Experts (SMEs) in NERC CIP regulations and implementations, suggested several paths for continued research focus as well as recommendations for energy critical infrastructure entity management teams to consider that may assist with NERC CIP program executions.

Considerations for regulatory officials were summarized in the conclusions and recommendations section of the research.

Results of the Study

The study on the effect of the NERC CIPs on the reliability of the bulk electric system resulted in nine themes (groups of similar data) listed below:

1. CIP standards, according to study participants, have had a positive effect on the reliability of the bulk electric system primarily due to the increase in cybersecurity awareness brought about by the CIP implementation requirements. Other factors expressed included a potential reduction in the damage that hostile code, introduced into equipment via a portable device or mobile media, could inflict. Measures put in place to satisfy CIP compliance requirements should reduce the efficacy of that type of attack.

2. Study participants pointed out that NERC fines influence the implementation of the CIPs. Entities fear the potential fines for noncompliance, up to and including the possibility of a $1M dollar/day fine for willful, negligent noncompliance with reliability standards. In addition, the public exposure and potential embarrassment (real or perceived) of noncompliance has been a motivating factor for NERC CIP implementations.
3. Study participants indicated that NERC entities are/have been removing equipment, via the letter of the law, in order to lessen the amount of equipment requiring CIP compliance. One study participant explained that entities were extremely motivated by the potential fines for non-compliance with regard to routable protocols. Rather than spend money to ensure the routable protocols were CIP compliant, returning serial communications to a TCP/IP upgrade that had been performed pre-CIPs seemed like an acceptable undertaking to avoid possible fines for routable protocol non-compliance.
4. Study participants indicated that companies fear that subject matter experts being removed from their systems of expertise to perform CIP compliance paperwork could result in those systems becoming vulnerable to a cyber attack which may result in the reliability of the bulk electric system potentially being put at risk.
5. It appears, according to study participants, that there is an emphasis on compliance with standards as opposed to security of a facility. In other words, an entity that is compliant with the CIPs by successfully completing an audit may not necessarily be cyber secure.
6. Other study participants expressed that the CIPs may have had a negative effect on the reliability of the bulk electric system, in some instances, for several reasons including a) entities spending money only on compliance efforts in lieu of strengthening their cybersecurity posture; b) time spent on CIP paperwork being disproportionate to system maintenance and security improvements, resulting in unintentional deterioration of system and equipment security; and c) entities choosing not to install equipment in order to reduce CIP compliance requirements, resulting in potential weaknesses in cybersecurity posture.
7. Study participants indicated that there exists a lack of common vocabulary across the NERC regions as well as between auditors and amongst entities. This situation may create confusion regarding regulatory intent of the CIPs culminating in misunderstandings, frustration, and entities possibly receiving fines for noncompliance when they are, in fact, compliant.
8. Inconsistent auditors and auditing paralleled the lack of common vocabulary, according to study participants, resulting in confusion regarding entity audit results. These inconsistencies were especially frustrating for entities operated by the same company but spread across multiple NERC regions.
9. Study participants expressed that cybersecurity is a dynamic process. Cyber defenders cannot get inside the heads of attackers and learn what attack they have planned next. As a result, cybersecurity must maintain a defensive posture against attack, reacting to and recovering from illicit hacks.

Conclusions and Suggestions

The findings from this study suggest academic research opportunities exist via correlational studies, causality research, and other quantitative methodologies. Opportunities for improvement within the energy critical infrastructure and its regulator were illuminated through the findings indicating inconsistent audits, a lack of common understanding of the vocabulary included in the

standards, and the lack of clarity all around (e.g., between energy infrastructure entities, NERC regions, auditors, and NERC itself). Management of the entities as well as the regulator could strive for greater transparency in the standards to improve implementation and lessen the likelihood of errors that could potentially result in regulatory fines.

Finally, as the smart grid continues development and implementation, the CIP standards will require retrofitting or revision to keep pace with technology. Currently, the CIP standards support a primarily analog bulk electric system. As analog technology is replaced with digital and the smart grid comes online, a plan should be in place to support that migration with appropriate reliability standards. As data in the study revealed, cybersecurity protection operates in a reactive mode with regard to response and defense against cyber attacks. As the smart grid continues implementation, appropriate cybersecurity standards should be administered to bolster preparation against cyber attack to the bulk electric system.

Marlene Ladendorff is an experienced cyber security and critical infrastructure specialist. Her areas of concentration include nuclear power and the electricity industry. Professionally, she has worked on a team writing and implementing the cyber security plan for a nuclear power plant to comply with 10 CFR 73.54. Academically, her Ph.D dissertation study focused on the NERC CIP standards and electric grid reliability. When she isn't busy working critical infrastructure cyber security issues, Marlene enjoys riding her horses competitively and ATV riding

VIII. Regulatory Impact Assessments

Una Shortall

The shift towards evidence-based regulation

The basic premise of economic regulation is to intervene in the market in order to redress market failure. Regulations, whilst fundamentally essential is such instances, bring costs as well as benefits. Indeed, "poor" or "broken" regulation can bring significant costs, sometimes possibly more than not intervening in the first place. Put simply, "poor" regulation, meaning regulation which is no longer "fit for purpose", can impose unnecessary burdens on society. A key driver of effective regulation is to achieve better results for society from regulatory interventions, and Regulatory Impact Assessments (RIAs) can help to achieve that objective.

With the principles of good regulatory practices firmly established[i] there is a growing emphasis on evidence-based regulation[ii]. A key tool for delivering policy which is evidence-based is the (*ex-ante*) Regulatory Impact Assessment (RIA), also called Impact Assessment (IA) or Regulatory Impact Statements (RIS).

What is an ex-ante Regulatory Impact Assessment (RIA)?

The RIA is an important tool which enables the decision maker, before making a policy decision, to consider the different policy options based on specific evidence. *Ex-ante* RIAs do not determine the final policy decision but are a key part of the decision-making process. RIAs can also contribute to improving the quality of regulation.

How are RIAs relevant to the work of national regulatory authorities?

National Regulatory Authorities (NRAs) play an important role in ensuring markets function properly and that the public interest is safeguarded.

This paper seeks to illustrate that RIAs, which are widely applied in general policy making terms[iii], are directly transferable (and in some cases, e.g. UK, already applied) to energy regulation. RIAs can help energy regulators in their pursuit of better regulation objectives. RIAs offer (one of several) routes to strengthened accountability in how the regulator has reached its decisions.

What's in a RIA?

RIAs assess the likely impacts, costs and benefits of new or revised laws or policy. RIAs tend to consider three core impacts (economic, social and environmental impacts), alongside other policy goals.

Whilst there are no hard and fast rules, RIAs tend to follow a set of key steps:

- Step 1 defines the problem and sets the objectives (and hence the need for the regulatory intervention).
- Step 2 identifies different policy options to redress the problem (including doing nothing) and the possible policy instruments to achieve that end (e.g. a new law or softer instrument). The different policy options are assessed in terms of their likely impacts, costs and benefits. The different impacts (direct and indirect) should be mapped first and then the associated costs (direct, indirect and enforcement) and benefits are estimated.
- Step 3 identifies the "preferred option". Consultation is an essential part of the RIA process.

- Step 4 provides for (interim) monitoring and evaluation ex-post (based on identified indicators) so as to measure whether the objectives have been met effectively and efficiently. Recent studies and best practices place increased emphasis on this final stage so as to ensure continuity between the *ex-ante* RIA and an *ex-post* review in a life-cycle approach to better regulation.

Is a RIA the same as a cost-benefit analysis?

The RIA is more than a cost benefits analysis (CBA) since it provides a framework to consider all impacts, costs and benefits associated with a given policy. The Impact Assessment guidance of the British energy regulator (Ofgem) makes clear that a CBA is only one element in the decision making process. Ofgem considers costs and benefits, distributional issues as well as hard to monetise considerations (see case study below).

Improving RIAs through stronger data, oversight and better consultation

The Organisation for Economic Cooperation and Development (OECD) (2015) sees the need to improve evidence-based policy through more and better Regulatory Impact Assessments (RIAs), including a more systematic comparison of cost-benefit analysis, stronger oversight and systematic stakeholder engagement.

The case studies in this paper show significant advances in addressing many of the OECD recommendations. Whilst the individual methods used to identify and assess costs and benefits are outside the scope of this paper[iv], the Australian case study below provides some insights into Australia's approach to facilitate consistent cost estimates. The European case study shows that the quality of European Commission impact assessments are now, for the first time, open to the scrutiny of a new independent oversight body, and the Commission has strengthened its commitment to consultation.

A shift towards better or less regulation?

Academic literature questions whether "better regulation" has given way to the political pursuit of something simpler, namely "less regulation" and imposing lower administrative burdens on business[v]. According to the European Commission, "better regulation" is not about "more" or "less" EU legislation but rather about delivering on the ambitious policy goals that are set (see case study below). Baldwin[vi] (2010) points out that policy makers are not only encouraged to apply RIA processes, they are urged (e.g. in the Hampton Review[vii]), *inter alia*, to cut red-tape, reduce regulatory burdens and structure enforcement policies – notably by adopting risk-based regulatory methods. Risk-based regulation is fundamentally about prioritising regulatory actions in accordance with a risk assessment (e.g., the National Energy Regulator of South Africa adopts a risk-based framework[viii]).

The remainder of this paper considers case studies in RIA best practices (two at executive/government level, and one energy NRA), before drawing some general lessons.

Case Study 1: Europe's Better Regulation Agenda

The European Commission (the executive arm of the EU Institutions) has a solid commitment to better regulation across all policy areas. The Commission's better regulation objective is to deliver evidence-based, high quality, initiatives that work as foreseen and remain "fit for purpose".

The European Commission's Better Regulation package (adopted in May 2015)[ix] marks a new wave of regulatory improvement on three main counts.

Source: European Commission

Firstly it establishes a shared responsibility by Europe's co-legislators (the European Commission, Parliament and Council) in delivering Europe's better regulation agenda. This is important because legislation often changes radically during the legislative process. Besides the Commission's own Impact Assessments (IA), now there should be an impact assessment on any substantial amendments that the European Parliament or the Council propose during the legislative process.

Secondly, 12-week consultations are a now mandatory part of the Impact Assessment (IA) process and of ex post "fitness checks" (explained below).

Thirdly, a significant change in EU policy-making is the newly created Regulatory Scrutiny Board (RSB) comprised of three high-level Commission officials and three external members (whereas previously the oversight body was an all in-house board). A positive opinion of the RSB is required for all Commission IAs tabled for adoption. The independence and veto of such an oversight body should not be underestimated in terms of quality control.

Ex Ante Impact Assessments

IAs are required for a wide range of European Commission initiatives and are mandatory when the expected economic, social and environmental impacts are "significant".

Quantification of all significant costs and benefits of the different options, including main groups impacted (e.g. consumers, workers, businesses etc.), is required to the extent possible. To compare the different policy options, the IA should indicate the impacts and the cost/benefit ratio, cost-effectiveness (efficiency) and other means of ranking such as multi-criteria analysis.

The European Commission has developed detailed, operational guidance on how to carry out an IA. This guidance includes, for example, advice on how to conduct a competitiveness assessment, the small-medium enterprise (SME) test, or how to apply the subsidiarity and proportionality principles. It also makes clear that the IA process should be of an appropriate scope and depth.

Ex Post Evaluation

Besides conducting *ex-ante* Impact Assessments (first introduced in 2003), the Commission has an *ex post* evaluation mechanism for individual initiatives and also (since 2010) comprehensive policy evaluations (called "Fitness Checks") to determine if the regulatory framework for a policy sector is fit for purpose. Fitness Checks are an important part of the EU's Regulatory Fitness

and Performance Programme (REFIT) which looks at the cumulative effect of regulation. REFIT aims to reduce the regulatory burden by making sure the existing stock of rules remain "fit for purpose".

Case Study 2: Australia's Regulatory Burden Approach

Australia has a highly developed approach to evidence-based policy making[x]. Furthermore, the government has committed to reducing the regulatory burden by AUS$ 1 billion annually.

Ex Ante and Ex Post Regulatory Reviews

Regulatory Impact Statements (RISs) are a core element of the regulatory policy making process in Australia, and a requirement for all significant regulatory policy proposals. The RIS provides evidence of the key steps taken during the development of the proposal, and includes an assessment of the costs and benefits of each policy option. There is a strong emphasis on consultation.

Australia also has a highly developed approach to *ex post* reviews with government agencies required to undertake *ex post* reviews (called "post-implementation reviews" or PIRs) for all regulatory changes that have "major impacts" on the economy or where there was no RIS when the regulation was introduced, removed or significantly changed.

Similar to the EU model, Australia considers the economic, social and environmental impacts of regulation. Australia looks at how different groups (individuals, businesses and community organsiations) are affected in terms of the distribution of the costs and benefits, with cost estimates calculated in line with the Regulatory Burden Framework (see below).

Solid quantification so that new regulations are cost-neutral

Australia introduced a major regulatory reform (in September 2013) aimed at reducing regulatory burdens and improving productivity. It requires that the cost burden of new regulation be fully offset by reductions in existing regulatory burdens. This requires all regulatory costs from existing, new or changed regulations (and offsetting savings) to be quantified (even for some actions by regulators that do not require a full RIS)[xi].

A cost calculator, called the Regulatory Burden Measure[xii], supports the quantification of regulatory costs: compliance costs and delay costs. A Regulatory Burden and Cost Estimate table must be populated for every viable option in the RIS. It calculates the average annual regulatory costs imposed on businesses, community organisations and individuals, and offset costs. The average change in regulatory costs is benchmarked against the "business as usual" costs absent the new regulation. Regulatory costs and offsets must be reconciled to meet the red tape target every 12 months.

Quality Control

Australia's Office of Best Practice Regulation (OBPR) plays a central role in assisting government departments and agencies in meeting their best practice regulatory impact analysis. The costings and offsets in every RIS must be approved by the OBPR[xiii].

Regulators' Self-Assessment Framework

Another important element of the Australian government's approach to better regulation and to cut red-tape was the development of a Regulator Performance Framework for regulators to review their own performance vis-à-vis six key performance indicators (KPIs). The KPIs cover reducing the regulatory burden, communications, risk-based and proportionate approaches,

efficient and coordinated monitoring, transparency, and continuous improvement. The first assessment period is the 2015-16 financial year.

A closer look at RIAs in energy regulation

Regulatory impact assessment requirements on energy regulators have been in place in some countries for years, whilst for others the RIA concept is new.

Case Study 3: Great Britain (Ofgem, the British energy regulator)

Ofgem, the independent energy NRA in Great Britain, is legally required to have regard to best regulatory practices.

Better Regulation

Ofgem's strategic mission is for its independent regulation to make a positive difference to every energy consumer. Ofgem follows better regulation principles (accountability, transparency, proportionality, consistency and targeting).

Each year, Ofgem publishes a Forward Work Programme of deliverables and an annual Simplification Plan setting out what it proposes to do to ensure it does not impose or maintain unnecessary burdens. Ofgem promotes, monitors and reports on its contribution against its strategic outputs.

Ofgem's Impact Assessment process

Ofgem has a statutory duty, since 2003, to undertake (and publish) Impact Assessments (IAs) for every "important" proposal. Over the years, Ofgem has developed a rigorous approach to IAs. In an effort to further improve its RIAs, Ofgem commissioned (in 2005) a review of its IAs[xiv] and developed Impact Assessment guidance[xv]0 (last updated in 2013) on how Ofgem conducts an IA (see figure 1 below).

As part of the IA process, Ofgem develops and refines (in an iterative manner) options for its important policy proposal which are assessed in terms of their impacts, costs and benefits (stage 3 in Figure 1 above). Key to this consideration are competition and consumers interest issues. An important aspect for Ofgem in the IA process is to consider, for every option:

(1) the monetised, aggregated costs and benefits (where it is proportionate to do so);
(2) the distributional effect (e.g. on different socio-economic groups/consumers/geographical areas); and
(3) the hard-to-monetise (strategic and long-term sustainability) issues.

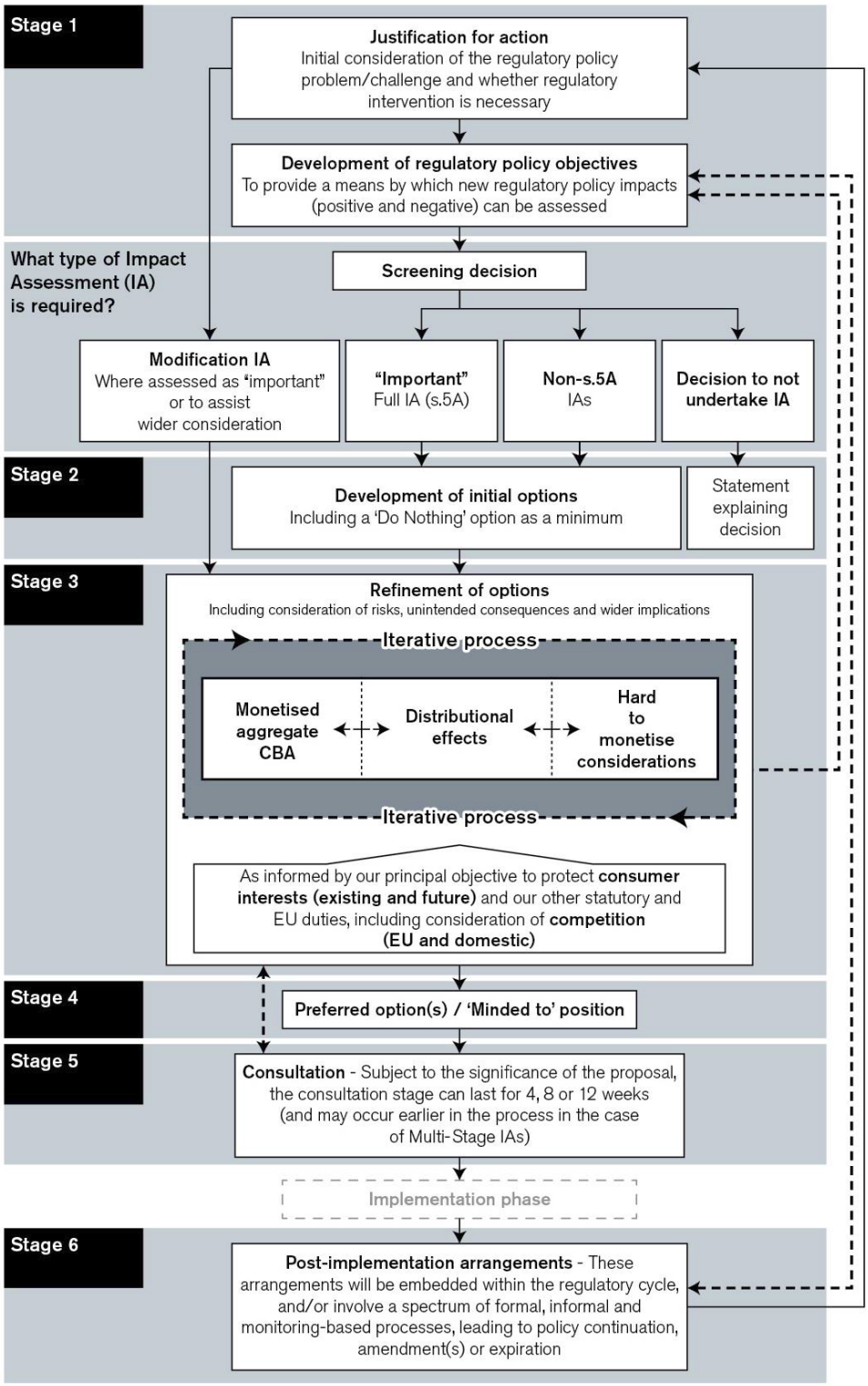
The IA also sets out Ofgem's preferred option (stage 4 in Figure 1 above). All final IAs must set out the intended (proportionate) approach to data collection and monitoring for post-implementation reviews.

Ofgem's consultations and Impact Assessments

Public consultation is standard Ofgem practice. In 2015 alone, Ofgem carried out 131 consultations, most of which contained some analysis of potential impacts.

Yet, a trawl of Ofgem's website yields relatively few Impact Assessments since it revised its IA Guidance in 2013. This is because there is flexibility in how IAs are presented. In practice, the IA is often integrated within Ofgem's core consultation document itself (rather than a standalone IA document, which is the European Commission's policy). In the financial year 2014-15, Ofgem published 10 standalone IAs, and made a further 8 decisions in relation to proposals which had undergone an IA.

Figure 1: Ofgem's 6-stage approach to Impact Assessments



Source: Ofgem Impact Assessment Guidance (2013)

Renda[xvi](2015) considers consultation on the RIA itself (rather than the content of the proposal) as particularly useful to focus on issues such as the quality of the analysis and data used in reaching a preferred policy proposal. Where Ofgem produces a standalone IA (which is normally the case only for major proposals), the IA itself is consulted upon alongside the main consultation proposal.

Going forward, Ofgem is looking to stronger quantification backed by internal peer review for its *ex-ante* IAs, as well as more *ex post* implementation reviews.

Conclusions

Better to get regulation right from the start and then evaluate

High quality regulation is vitally important. Evidence-based regulation has achieved broad acceptance within governments and many regulatory bodies. *Ex-ante* RIAs provide a framework for evidence-based options to inform decision making, and help support better quality laws, policies and regulation. The *ex-ante* RIA should also foresee how the intended outcome of the policy will be monitored and evaluated (in terms of efficiency and effectiveness) in an *ex-post* review. Furthermore, in line with the OECD (2015) recommendations, countries should be more strategic and systematic in reviewing their policies, also for cumulative impacts in a sector as a whole.

The case studies in this paper show major in-roads in using and improving RIAs. Jurisdictions (such as Australia and the European Union) with highly developed RIA requirements at executive level place significant emphasis on quantification in both *ex-ante* RIAs and *ex-post* reviews, and increasingly have a focus on reducing the regulatory burden. The proportionality principle (both in terms of when to conduct RIAs and the depth of the analysis) and of embedding consultation in the RIA process is very much underlined.

Reducing the regulatory burden could soon be an obligation for energy NRAs

It is a reasonable expectation for regulators to gravitate towards better regulation approaches, regularly reviewing their practices to make sure they reflect current thinking, and to be performance focused.

Regulators also need to appreciate that governments are more and more focused on reducing the regulatory burden, particularly to businesses (e.g. the “one in, two out” policy in the UK to reduce the flow of new regulation, the “cost-neutral” approach in Australia, and the European Commission’s efforts to reduce and improve the stock of existing regulation). Increasingly, public authorities (including energy regulators) are being required to report on their performance and regulatory (burden) costs, in an effort to identify and reduce those costs. Ofgem will soon have a legal obligation to report on costs (added or reduced) to businesses, with such costs (not the entire IA) being subject to scrutiny by the UK’s verification body, the so-called Regulatory Policy Committee (RPC).

Lessons for Regulators on Regulatory Impact Assessments

Several lessons can be drawn from good regulatory principles and current RIA best practices.

Consult early and often. In keeping with the principles of transparency and openness, public consultation should be embedded in the RIA process.

Be clear. The development (and publication) of guidance outlining your approach to RIA (similarly for public consultations) is important so as to ensure consistency and transparency.

Quantify. Map the different impacts (economic, environmental and social) and then quantify the costs and benefits for the different policy options.

Be proportionate. The depth of the analysis, the data collection and the monitoring should be commensurate with the level of the impacts. The bigger the impact, the more in-depth the analysis should be.

Expertise matters. A core set of economists or staff with quantitative skills to undertake RIAs and training is needed.

Enshrine best practices. Embedding RIA into the culture of the organisation is important so that the RIA process is not perceived by staff as a necessary burden. All regulators should strive to be best-in-class regulators.

Be open to scrutiny. In order to ensure robust evidence-based analysis, peer review is a first step. However, external review works best. Independent scrutiny bodies (like OBPR in Australia, the RSB in Europe, or RPC in the UK) monitor and report on compliance with RIA requirements, and often assist in many ways such as the impacts, and cost calculations.

Learn by doing and sharing. Even if rudimentary to begin with, the practice of conducting an RIA can deliver huge benefits. Over time, through incremental improvements the RIA can help to identify the most effective, least burdensome, policies (e.g. better quantification, identifying indicators from the objectives, post implementation reviews).

The OECD (2015) considers the quality of regulation to no longer be a domestic issue and encourages international regulatory cooperation to ensure the effectiveness of regulatory frameworks. The International Confederation of Energy Regulators (ICER) is an important platform which facilitates the development and exchange of best regulatory practice among energy regulators worldwide. This paper is an initial introduction to RIAs which, it is hoped, could spark further exchanges on RIA practices, leading to deepened understanding of RIA best practices.

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References:

i See for example, the CERRE Code of Conduct and Best Practices for the setup, operations and procedure of regulatory authorities (2014); the OECD Recommendations of the Council on Regulatory Policy and Governance (2012); the OECD Best Practice Governance Principles for Regulators (2013) and the CEER Memo on Principles for Regulatory Performance Assessments (2015).

ii CERRE, a European think tank, advocates 2 key principles to govern regulatory authorities' decision making: evidence-based decisions; and stakeholder involvement.

iii The OECD Regulatory Policy Outlook 2015 includes country profiles for all 34 OECD countries plus the European Union, including indicators evaluating countries' approaches to regulation and RIAs. It contains interesting chapters on stakeholder engagement, *ex ante* RIAs, and *ex post* evaluations.

iv See the "Assessing the costs and benefits of regulation", a CEPS-Economisti Associati study for the European Commission (2013), the European Commission's online Better Regulation Toolbox, the OECD Regulatory Compliance Cost Assessment Guidance (2013), and the UK's HM Treasury's Green Book: Appraisal and Evaluation in Central Government (2013)

v The Oxford Handbook of Regulation (2010), edited by Robert Baldwin, Martin Cave, and Martin Lodge (2010).

vi Baldwin (2010) in the Oxford Handbook of Regulation (see reference v above).

vii The 2005 Hampton report recommended that all UK regulators should operate a risk-based system. See Hampton, P. "Reduction in Administrative Burdens: Effective Inspection and Enforcement", London, 2005.

viii Under its risk management policy, NERSA conducts a risk identification and ranking exercise to rank the risks facing the organisation. NERSA then determines its risk appetite (or amount of risk it is willing to accept in pursuit of its mission or vision) and risk tolerance level, and identifies additional strategies to mitigate the risk.

ix The Better Regulation Package includes, *inter alia,* a European Commission communication; an inter-institutional agreement; a decision setting up the Regulatory Scrutiny Board; the Better Regulation Guidelines and a detailed Better Regulation Toolbox to assist practitioners in conducting Impact Assessments, Evaluations and Fitness Checks.

x See the Australian Government Guide to Regulation (2014) and the Guidance to the Council of Australian Governments (COAG) (2014).

xi The OBPR's Best Practice Regulation guide for calculating the (change in) the regulatory burden was updated in February 2016.

xii The Regulatory Burden Measure is a web tool to estimate the cost impact a regulation or policy proposal.

xiii For compliance reports and further information visit the OBPR website.

xiv A Review of Ofgem's Regulatory Impact Assessments by the Regulatory Policy Institute, Oxford (2005).

[xv] Ofgem's Impact Assessment Guidance (2013).

[xvi] Renda, A. (2015) "Regulatory Impact Assessments and Regulatory Policy" in Regulatory Policy in Perspective: A Reader's Companion to the OCED Regulatory Policy Outlook 2015, OECD Publishing, Paris.

IX. Efficient data exchange as a prerequisite for a prospering electricity market and as a facilitator for smart homes

Walter Boltz and Leo Kammerdiener

This article focuses on the requirements and present lessons learned which are necessary to establish a future-oriented market model and to create appropriate business opportunities for suppliers, developers of smart appliances and related businesses. A national regulatory authority about to address such a task might consider that, as with all communication technologies, it is essential that there be standardised data formats and a standardised communication protocol for each communication process. But first things first: the term "process" implies that the underlying business processes must be analysed before standardised data formats can be developed.

Hence, the **first lesson learned** is that a deep business **process analysis and optimisation** is the key for a good outcome. Of course, data formats as such are important, but a preceding analysis of business processes is even more crucial. Without it, a regulator risks drawing the wrong conclusions and interfering at the wrong stage or place. Questions like "which processes do we need to know" and answers like "there is no specific process yet" will usually come up during this phase. In Austria, for instance, the first smart meter roll-outs changed the mind-set of network operators. They realised that the "old world" characterised by monopolistic behaviour is ending and that the "new world" is a process-driven one. Therefore, smart meters could be seen as an initial catalyst or enabler for deeper business process analysis.

Thus, the **second lesson learned** is that the **roll-out of smart meters is process driven**. Only if properly defined, business processes are implemented, DSOs are able to face the challenge of an efficient smart meter roll-out and the huge amount of devices that have to be installed. A deep preceding business process analysis (starting with the roll-out process and ending with ongoing processes for when roll-out is finished) is necessary to cope with this task. In this, the meter is the initiator for the analysis but experience shows that many processes beyond metering are concerned (e.g. billing, payment reminders, etc.). For many companies this will mean a substantial change of circumstances, a veritable transformation from the "old world" into a "new" one. The meter will play a central role.

Lesson learned number three is that data aggregation and non-discriminatory provision of available **metered** data is absolutely necessary if we want to succeed in establishing a future-oriented market model. Meters are sensors which produce a huge amount of data (e.g. on a quarter-hourly basis, on power quality etc.). This data must be available for market participants. The intersection between metered data and all other available data (e.g. those created by smart home appliances) is fertile ground for future business models. The focus in our following considerations will be on this intersection – or especially their separation.

The role of the "data availability paradox" for the design of a future-oriented market model

The design of a future-oriented market model requires a strong focus of regulators on the scope of regulated activities within the underlying legal framework. Normally, the separation of activities under regulatory control from market-driven activities is taken as a matter of course. But sometimes, regulators over-emphasise the dogmas of non-discrimination and equal

treatment of market participants in their enthusiasm to fulfil their regulatory goals (some self-criticism should be allowed here). E-Control Austria found that there is indeed a "data availability paradox": if data (especially smart home related data) is made available in a non-discriminatory, standardised format to all market participants[1] (e.g. suppliers[2]), the competitive edge of those that already have this relevant data today (e.g. through home appliances which are already installed) or those that are willing to obtain this data in the future is blunted. For these companies it would be a penalty to have to share customer-related data with others, because they were initially acting out of – and were incentivized by – market forces to gather information from their customers. Only, the "old world" companies in the energy sector failed to do so in an appropriate way; in the past, these "old world" companies had no real interest in understanding customers' wants and needs, knowing how they behave in their households and finding out how they use their energy consuming equipment. But now times have changed and nowadays, "old world" companies would want access to all data generated by consumers. This is only natural, as this data has become a very valuable resource.

At the other end of the spectrum, companies which are exposed to competitive market forces (which is true for all sorts of producers of smart home appliances) have in general always been highly motivated to know everything about their consumers. Energy-related data were gathered as a by-product of this desire for information. And the ability to switch electrical equipment on and off at the customer's premises is equal to the decision to use energy or not at a specific moment[3]. If they were to market these possibilities, this would be equivalent to companies in the production industry that are selling waste which is produced during production process[4]. The **fourth lesson learned** is thus that **data availability** is limited to metered data and that additional data should not be made available for free, because this could distort the market.

The following example illustrates how important a differentiated view of the separation of market and regulated activities is and how this separation can be applied.

Separation of regulated activities from market activities

The above discussion of smart meter data immediately begs the question of where regulatory authorities should draw the line between smart home and smart meter activities within the underlying legal scope and how they could ensure that they determine the right regulatory actions. In E-Control's case, the above considerations led us to the following simple architecture as useful approach derived from Austrian law: metering activities are not liberalised in Austria. Therefore, network operators are responsible for metering activities. Metered data has to be

[1] Of course only with the contractual agreement of the customer

[2] On the issue of market participants, we consider that also companies that do not participate in the energy sector at the moment, like developers of home appliances etc., will probably take part as facilitators in the energy system in the future

[3] Many of these companies can switch appliances on and off in real-time, but this is not generally their core business. Consider for example a producer of heat pumps which provides online services for its customers; switching is not the main focus here. Another example would be a producer of uninterruptible power supply which can shift the schedule of the maintenance cycle of each cell in a battery pack; this means that energy may be used or released at a specific time.

[4] Where the production process is the core activity and resources which are burned and left over and which may not be used any longer for this production process may be sold as waste. Compared to the energy sector this would mean to bind capacities or to free capacities, which may not be used in the actual production process any longer.

collected by them and availability of this metered data is guaranteed by law[5] and through an ordinance[6] issued by the regulatory authority.

With the obligation to publish metered data and to make this data available to market participants (which of course the consumer has to agree to), the end of the regulated activities is reached. In our view, all other activities should be exposed to market forces, i.e. in a non-regulated sphere. This is our **fifth lesson learned** or recommendation: that a focus on the **separation of regulated from non-regulated activities** is essential.

Trust in market forces

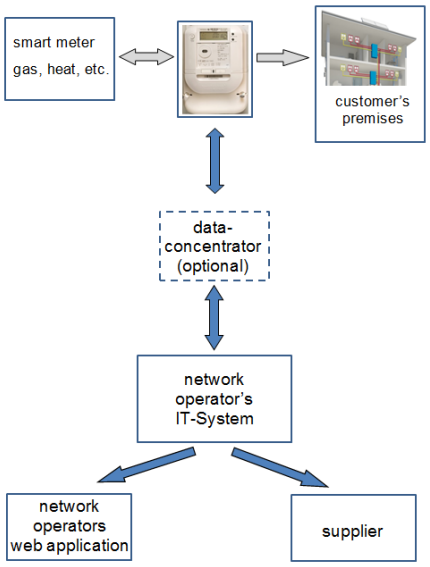
The main question in this regard is whether regulators trust market forces. It is a basic principle of regulation that regulated activities should provide fertile ground for non-regulated activities. Concerning smart homes and the wish to facilitate the development of smart homes, one might wonder whether regulatory intervention was really necessary to stimulate the roll-out of smart homes. The answer in our case was a clear "no." In the past, smart devices were developed without any regulatory intervention. Smart cars, smart homes, all kinds of smart appliances are good examples of developments which resulted from simple entrepreneurship. Indeed, in most of these cases regulation hinders rather than supports developments.

Smart home manufacturers are not normally "old economy" companies, so they probably do not need to be treated in a similar way. Innovation is their core business activity and hence no innovation incentives are necessary for them. This immediately uncovers another dilemma: if the regulatory framework were extended to include smart home activities, behaviour within this framework would likely lead to the need for incentives to encourage development of appropriate software and devices. Failing to clearly separate regulated from market activities is like opening a veritable Pandora's Box. Our **lesson learned number six** is therefore to **have trust in market forces** and to reduce the regulated sphere as much as possible.

The below table illustrates the separation of activities in detail, using smart meter data and market development as an example.

[5] The Austrian *Elektrizitätswirtschafts- und -organisationsgesetz* (Electricity Act) 2010.

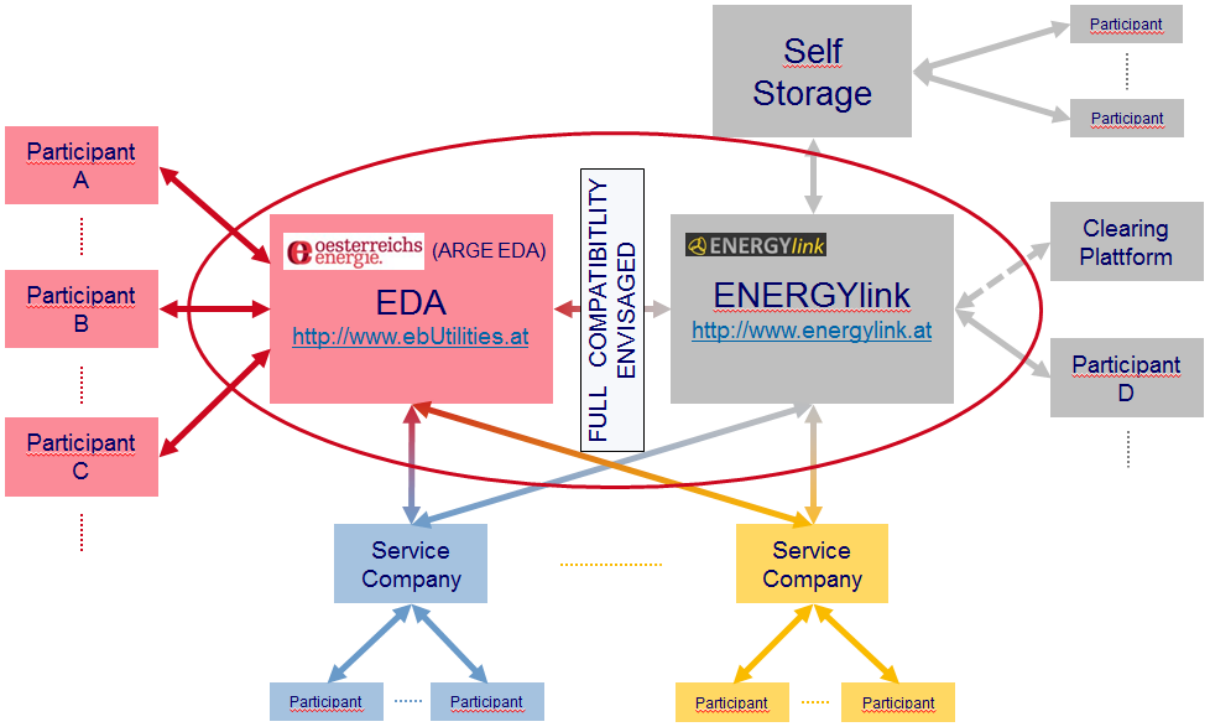
[6] The *Datenformat- und Verbrauchsinformationsdarstellungsverordnung* (Data Format and Consumption Data Ordinance) 2012, last amended in 2013.

Activities	Regulated Activities	Non-regulated Activities
Security level	High security standards like VPN, PKI Environment, etc.	Security level up to companies
Latency	No real-time necessity, long-term oriented	Real-time, short-term
Reliability level	Highly reliable, stable	Reliability level depends on activity and is up to the companies
Architecture		

How can regulated and non-regulated activities fit together?

In the table above, the activities on the left-hand side are among the core tasks of network operators: measurement activities. The focus has to be especially on the triangle at the bottom, i.e. the network operator's IT system (including the network operator's web application) and the supplier.

To keep the "efficient data exchange" promise made in the title of this paper, we also want to discuss the data exchange between network operators, suppliers and other stakeholders (where customers have agreed that they access this data). The situation in Austria may be best explained by the below figure.



"Participants" in the figure above may be regulated or non-regulated companies. Ideally, where consumers agree that the operators of their home appliances may access their metered data, these companies should be able to easily connect to the system as "participants". Suppliers are then able to analyse load profiles of their potential customers, and this could be one way how the regulated world connects with the non-regulated world.

Clearing on a quarter-hourly basis will force forecasts to be more precise

Along with the current smart-meter roll-out, E-Control Austria is planning to introduce an option for quarter-hourly clearing which can be offered by suppliers on a voluntary basis. We expect that this will also bring about major changes in the behaviour of suppliers. At the moment, all suppliers are cleared (i.e. settled for open positions) according to standardised load profiles. The only risk that suppliers have at the moment is the risk for the amount of energy consumed. But while this means very limited risk exposure, it also means there is no chance for further income. Introducing a voluntary quarter-hourly clearing option in a first step and possibly obligatory quarter-hourly clearing afterwards will lead to a situation where precise forecasts for e.g. day-ahead schedules are necessary. Companies that optimise their portfolio will be able to create value through better and more sophisticated forecasting techniques and will have incentives to avoid wrong forecasts. Which is exactly the point where non-regulated, real-time appliances come into play. The right-hand side in the above table will find synergies to cooperate with companies that run danger of having to pay for balance energy.

The system is also open for pooling concepts, which we consider one instance where a clear separation between the regulated and the non-regulated sphere is difficult. Consider the example of an appliance operator that switches tens of thousands of refrigerators on or off; surely, the network operator should know about this. For single switching actions, this would be not necessary, just like at the moment, nobody is obliged to call their network operator or the

operator of a power plant if they intend to switch on or off their lights or their stove. There would be an additional business opportunity for suppliers in selling small batteries to consumers, to shift consumption from one quarter-hour to another, or in using bigger ones to shift between days. It could also be a business opportunity for companies to operate battery parks and sell capacity to other market participants. And the list goes on. Which leads us to the **seventh and last lesson learned** that we would wish to present in this paper: **clearing on a quarter-hourly basis** will lead to **more precise forecasting** techniques and will open up business opportunities in absorbing deviations between planned and actual schedules (non-regulated, real-time products based on hard- or software developments).

These considerations are of course strongly connected with flexibility issues, but that would be going beyond the scope of this paper.

Conclusions and regulator's recommendations

1. A deep business **process analysis and optimisation** is key.
2. **The roll-out of smart meters is process driven.**
3. **Data aggregation** and **non-discriminatory provision** of available **metered** data is the key for successfully establishing a future-oriented market model.
4. **The "data availability paradox": Data availability** is limited to metered data and additional data should not be made available for free, because this could lead to market distortion.
5. Focus on the **separation of regulated and non-regulated activities** is essential.
6. **Have trust in market forces.**
7. **Clearing on a quarter-hourly basis** will lead to a need for **more precise forecasting** techniques and also to business opportunities in absorbing deviations between planned and actual schedules.

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X. In the orbit of the European gas world – a brief description of the successful launch of the COSIMA satellite market

Johann Breitenfelder

In operation since 1 October 2013 and comprising the western Austrian market areas of Tyrol and Vorarlberg and Germany's Net Connect Germany (NCG) market area, the "Cross Border Operating Strongly Integrated Market Area" (COSIMA) could be seen as the European Union's first satellite market according to ACER's Gas Target Model. COSIMA was developed by AGGM Austrian Gas Grid Management AG (AGGM) together with the market participants (German TSOs and Austrian DSOs) and the Austrian and German regulatory authorities, Energie-Control Austria (E-Control or ECA) and Bundesnetzagentur (BNetzA).

On the one hand, COSIMA had become necessary in order to implement the entry/exit system for European gas markets in the western Austrian market areas of Tyrol and Vorarlberg as specified in the Austrian Natural Gas Act (GWG 2011). On the other hand, the market areas of Tyrol and Vorarlberg and the Eastern market area, to which all other Austrian provinces belong, were not directly connected. Building such a direct connection would not be economically feasible in the foreseeable future and is thus not included in grid expansion plans.

Figure 1: Market Areas

Satellite market

According to ACER's Gas Target Model "satellite markets" are described as "substantial linking (via pipeline capacity) of a non-functioning gas market to a directly neighbouring functioning gas wholesale market, hence allowing the satellite market to co-use the neighbouring gas wholesale market on the basis of simplified processes while maintaining its own balancing zone."

Within the COSIMA model, a natural gas supplier wishing to supply customers in Tyrol or Vorarlberg is required to set up a balancing group in one of these two market areas and a

corresponding balancing group in the NCG market area. Suppliers may make use of existing balancing groups for this purpose. AGGM is responsible for transporting gas between countries and for this purpose aggregates the requirements and books the total line capacity required. The natural gas procured at the VTP in the NCG market area (VTP NCG) is then available in Tyrol or Vorarlberg. AGGM also procures the external control energy used to physically balance the volumes of gas supplied at the VTP NCG and the volumes actually required. To this end, products offered in the natural gas segment of the Leipzig Energy Exchange (EEX) are used. Preliminary computational balancing is done between the Tyrol and Vorarlberg market areas in order to minimise control energy requirements.

With COSIMA, a cross-border satellite market was established avoiding any substantial changes to the regulatory frameworks applicable to the gas markets in Austria and Germany. Adaptations were basically required only in specific technical details. AGGM's role within COSIMA is comparable to that of a 'translator' between the two regulatory systems. In this capacity it provides gas suppliers operating in Tyrol and Vorarlberg with a relatively simple means of fully accessing the VTP NCG, a wholesale trading point with high liquidity and transparency.

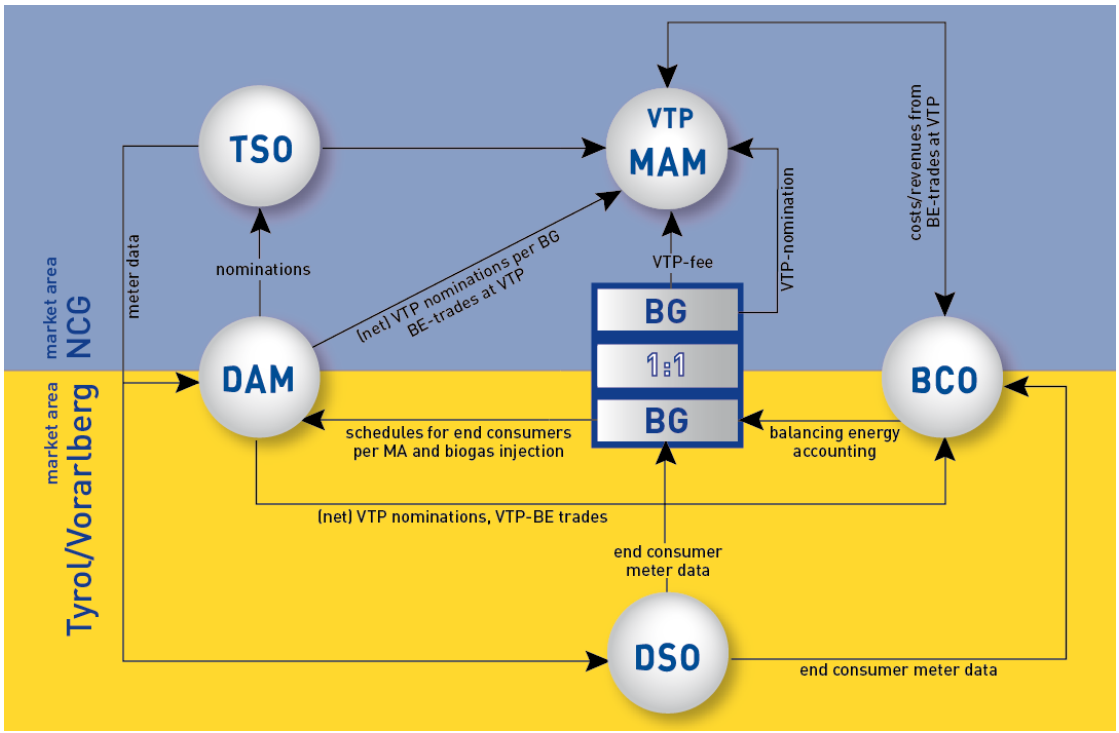


Figure 2: COSIMA

Stimulating competition

Against this background, the Austrian regulatory authority E-Control expected new suppliers to enter the market, both in the large consumer and the business and household segments, in this way providing added stimulus to competition. This expectation has since been confirmed. A total of fourteen new suppliers entered the market in Tyrol and Vorarlberg by the end of March 2016. Yet, at roughly 500 million cubic metres (about six percent of Austria's total natural gas needs), annual gas requirements in Tyrol and Vorarlberg are relatively low. The gas grids in Tyrol are

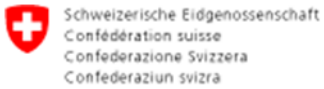
owned and operated by TIGAS-Erdgas Tirol GmbH and Erdgasversorgung Ausserfern GmbH, and in Vorarlberg by Vorarlberger Energienetze GmbH and Stadtwerke Bregenz GmbH.

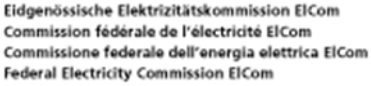
Outlook

To sum up, COSIMA has been in place and working without any major problems since its launch in early October 2013. Nevertheless, there is scope for improvement. For example, BNetzA categorises AGGM, the distribution area manager for all of Austria, as a gas trader and not a system operator. Among other disadvantages, this prevents AGGM from making full use of network coordination mechanisms. For example, AGGM is unable to access linepack, which could be used to meet fluctuating demand using gas already in the system. Instead, it is forced to procure gas for this purpose from NCG. This results in unnecessary balancing energy charges that ultimately have to be borne by consumers.

Supplying gas to Liechtenstein and Switzerland will be part of expanding COSIMA from 1st of October 2016 onwards and is currently carried out under transitional arrangements. Thus AGGM guarantees the transportation via Vorarlberg of around 60 million cubic metres required by the gas suppliers involved. Switzerland is presently debating its future gas market model. More than 100 system operators are involved in that discussion, and time pressure is less of a factor because Switzerland is not a member of the European Economic Area (EEA). Liechtenstein is in the final stage to decide on its new model, that will enter into force on 1st of October 2016. AGGM is in regular contact with Liechtensteinische Gasversorgung (LGV) to offer support out of many years of experience working in a liberalized gas market and prepare for implementation.

Johann Breitenfelder is the Head of System Access & Capacity at AGGM Austrian Gas Grid Management AG. He possesses an educational background in telecommunication engineering and electronics. In his career, he has also served as a telecommunication engineer and energy analyst in the gas division of OMV AG and as a market analyst at OMV Cogeneration GmbH.



XI. ICER Reports

Reports

ICER's Virtual Working Groups prepare reports on various topics, including Reliability and Security of Supply, Smart Meters, Consumers, Market Integration and Managing Investment Uncertainty. Find published reports in ICER website's publication page (http://bit.ly/1HZKU2b).

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