THE ICER CHRONICLE

A FOCUS ON INTERNATIONAL ENERGY REGULATION

EDITION 4, NOVEMBER 2015

The ICER Chronicle

Edition 4, November 2015
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Table of Contents

I. Foreword

Welcome to the 4th edition of the ICER Chronicle.

This edition is my first as chair of ICER and initially I would like to take this opportunity to thank Lord Mogg for his excellent leadership and wish him every success in his new endeavors.

We hereby are pleased to share some insights on recent activities of ICER which continues its efforts to steer its members and audience towards best practices. The World Forum on Energy Regulation (WFER) is the foremost of these, which we have organized in Istanbul in May this year. As WFER is always an inauguration for a brand new term, over the next three years, ICER plans to create more value through better communication involving all stakeholders and the substantial work it produces. Strong relationships, more reflection and of course, improved competence around the world will be our focus in line with amplifying expectations.

With increasingly complex interdependence of spheres and geographies, the delicate problem of designing and implementing smart regulation has become more pressing. While context may set boundaries with different styles, cultures and histories, sweeping technological innovations and challenges such as climate change and energy poverty blur those boundaries. 21st century society is “risk society” where risk has become a commodity and has diffused into all other industries. Energy policy credibility and convergence have thus become more pertinent than ever. Cooperation and collaboration of agencies to exploit economies of scale and scope are increasingly in demand for regulatory innovation.

Our fourth edition of the ICER Chronicle once again attempts to clarify how our empirical and theoretical repertoire could be enriched.

The articles chosen by the Editorial Board for this edition are wide in scope, both geographically and temporally, and includes normative conclusions (such as vitality of “trust” for effective regulation and necessity of regional integration). Incentivizing renewables’ deployment, standardization and data utilization of distributed resources, evolving WACC model, energy-health interface, market creation, consumer empowerment via actionable information and heterogeneity of markets within certain regions are the underlying themes in this edition.

It is now indisputable that regulatory agencies have to be more flexible, reflexive and agile in responding to this rapidly evolving economic environment. Willing to respond to such necessity, the Chronicle not only addresses electricity and gas regulators of different parts of the globe, but also policy makers, academics, consultants and professionals with an interest in energy regulatory affairs. Through its pages we aim to share good practices, leading edge thinking and novel approaches to challenges faced by energy regulators which can begin to inform other policy and practices in other jurisdictions.

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.

Alparslan Bayraktar
ICER Chairman

II. Welcome from the Editorial Board Chair

On behalf of ICER Working Group 4: Regulatory Best Practices, I am excited to share edition 4 of the ICER Chronicle. The Chronicle is a means to further promote ICER's goals of enhanced exchange of regulatory research and expertise. If you missed previous editions, please visit: http://www.icer-regulators.net/portal/page/portal/ICER_HOME/publications_press/ICER_Chronicle/Archives

The Chronicle is published biannually in order to share information among international energy regulatory agencies and beyond. If you haven't received this subscription directly, you can join our list-serve by emailing chronicle@icer-regulators.net.

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. The deadline for consideration for inclusion in the fifth edition of the Chronicle is January 29, 2016.

Finally, I would like to thank the dedicated members of our Editorial Board. They thoughtfully reviewed all submissions and assessed those that are particularly interesting and timely to the global regulatory community.

Sincerely,

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Chair, ICER Virtual Working Group 4: Regulatory Best Practices

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Support Team

Many thanks to the following support staff who contributed to the review, design and development of the Chronicle:

Council of European Energy Regulators (CEER)
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Ms. Anh Tran, ICER Secretariat

National Association of Regulatory Utility Commissioners (NARUC), United States
Mr. Charles Gray, Executive Director
Ms. Erin Hammel, Director of International Programs
Ms. Katherine Bennett, Program Officer, International Programs

III. Women in Energy (WIE) Story Telling

Readers asked for us to widen our Women in Energy story-telling also to non-regulators. We listened. You responded. From the many submissions received we selected two great stories from America for this 4th edition of the ICER Chronicle.

Pamela Frank's (Gabel Associates, a US consultancy) passion for energy comes through in her story. She shares the skill sets she has consciously employed, as a woman, to bring about change in a complex industry.

Sheila Hollis (Duan Hollis, a US law firm and formerly the first Director of Enforcement at FERC) speaks of riding the wave of change, being flexible and of learning so as to be wiser and more capable of evolution, professionally and personally.

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

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 women in energy story-tellers. Keep the stories rolling in!

Una Shortall
Chair of the ICER Women in Energy Steering Group

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

Our WIE network is open to men and women of **ICER's energy regulatory authorities**.
It's free to join! Visit http://bit.ly/ICERWomenInEnergy

Women in Energy Story Telling:

My Source of Power

by Pamela G. Frank

Pamela Frank, Vice President of Gabel Associates, has over 20 years of experience in sustainability issues and the renewable energy industry. She supports the firm's efforts related to the development of renewable energy, advanced technology, energy efficiency projects in addition to regulatory, policy, and analytical activities for these markets.

Ms. Frank has expertise on project development issues, including the evaluation of cost effective financing approaches. She has served as a key stakeholder in the development of the solar energy market in New Jersey, which is considered one of the largest, most innovative markets in the nation.

When people ask me what I do, like any good politician, I attempt to answer the question I want to be asked - why do I do it? My answer begins simply. "I work in energy." And then I continue with "and here's why, " which is usually something along the lines of the following:

The way we create, move and use energy is at the foundation of our relationship with our planet, and tied closely to how we are able to advance our collective humanity. Throughout human history, and especially since the Industrial Revolution, many of our advancements have come at the expense of the planet. My work in energy is about having our cake and eating it too; making energy and all of the benefits that come with it, widely available and doing so in a way that is much more in harmony with all the living systems that comprise our planet.

That's more or less my elevator speech.

I've been involved in this work in one way or another for over 18 years. One of the great highs of my career was my involvement in New Jersey's Solar Energy and Fair Competition Act of 2010. Legislatively codifying eight years of regulation on the eve of a change in Administration gave the solar market the certainty it needed to attract capital and build scale. We changed the rules of the game. However, that didn't happen overnight.

I am sometimes asked how I got into all of this, a question I like to answer because it speaks to the serendipity of life, and to being open to possibilities.

I began to study effective leadership, particularly the life of Francis Perkins, the first female member of a US Cabinet in FDR's Administration. I learned that Perkins was impacted deeply after witnessing the Triangle Shirtwaist fire. Female workers perished in a sweatshop where management neglected safety, health and basic dignities. She recognized the unique role she could play as a woman to achieve safe working conditions and later, helped lay the foundations for social security and other social safety net programs. Understanding why and how she worked has been instructive in my work.

Related to improving working conditions is the idea that in order to ensure talented women can remain and grow into positions of leadership in the energy field, workplace flexibility will be key. With multiple demands on their time to keep balance in their life, women need the flexibility to work off-site and outside the 9-5 box.

My path into the field of energy was anything but direct. I studied philosophy, dropped out of law school dropout and finally got my Masters in Public Health over four years (while having my two children). In 1992, I was hired as a Community Organizer for a large philanthropic Jewish organization. My Chairman explained to me on the first day of my job that he wanted to put the

organized Jewish Community “on the map” when it came to environmental issues. I smiled and nodded, but in the head of this Jersey Girl, what came to mind was the Valley Girl response“ gag me with a spoon.” It was not an exaggeration to say I had absolutely no interest in this area.

That same year, however, I began to follow the international community and the first Earth Summit in Rio de Janeiro. A number of publications resulted, including some of the first compelling research around climate change. I met with several of the area faith leaders that would later serve on the board of the not-for-profit GreenFaith.org, which I helped start and served as the Founding Executive Director. (GreenFaith mobilizes, educates and inspires people of all faith backgrounds to work as leaders for environmental stewardship). They came back from Rio determined to address the human impact on climate by creating a moral imperative utilizing an interfaith voice. They inspired me. I began to organize and read. I quickly became intrigued and alarmed on the issue of climate change. Being someone who is always drawn to root cause issues, I also became increasingly interested in energy.

By 1997, GreenFaith was organized as a not for profit, and we foresaw the deregulation of electricity in the not to distant future. This would happen in New Jersey in 1999, and GreenFaith took that as an opportunity to begin educating citizens on the choice before them - how electricity is generated, transmitted and used has implications for the planet so chose wisely.

I learned a lot in those early years. First, it became apparent that the power of choice driven by moral imperative alone to significantly and quickly change the market for cleaner energy sources was not going to work. Second, in the United States we had done such a superb job at building energy infrastructure that while always there for us, it was invisible and most people took it for granted. It was challenging to compel people to choose something they couldn’t see and when what they already had was working just fine. Third, asking people to pay more money for the invisible product they didn’t think they needed was really hard. Finally, it was challenging to connect spending more money for cleaner electricity back to the problem of Climate Change - also invisible.

What I took away from those early years in not-for-profit was in order to effect impactful change in this area, you have to get into changing the rules of the game.

A large part of my contribution, and one of the biggest challenges was bringing all necessary stakeholders together to pass historic solar legislation in New Jersey. This involved the careful managing of egos and providing a sense of ownership that what they were doing collectively was historic. At one critical meeting, I actually threw bars of chocolate on the table exclaiming we would have to earn that chocolate by reaching a deal. Injecting humor, a shared sense of purpose, demonstrating respect for all involved, regardless of whether I agreed with positions were all important elements of creating the constructive environment in which we could all work toward a common goal.

Over five years after The Solar Energy and Fair Competition Act, New Jersey has over 1.5 GW of solar in the ground – or as I like to think of it, a nuke plant worth of solar. We have over 7,500 jobs attributable to this industry – good jobs that are also infused with a sense of purpose. Visiting a solar warehouse is an inspirational experience.

How does one effect change in energy? It is a complex area; especially considering the layers of regulation, the different jurisdictions, and the number of entities involved that set the rules in which the many energy markets operate.

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Reflecting on this experience several years later, I realize my contribution, being one of the only women in the room, was uniquely feminine. Harkening back to strategies that Francis Perkins deployed, being highly strategic and fostering a sense of community, shared purpose, and mutual respect was crucial to reaching a deal and was also how I exercised an effective form of leadership.

In the complex energy ecosystem, the biggest challenge for me is making the strategic decision on when to push for revolutionary change versus evolutionary change: is it the time to go big or do you take baby steps which some may say (I do not) is equivalent to "going home?" Over my career, I have found that decision comes down to judgment on any number of factors that may influence outcomes - timing, personalities, politics, current events including the weather, to name just a few. Exercising good judgment is a risky business, which is why it's my number one challenge.

Looking to the future, for any young women considering this work, I have several ideas to share.

First and foremost, you have to master the subject. There are no short cuts. In order to be in a position to exert leadership and effect change, you must be a credible contributor. So read, learn, and seek out good people to answer your many questions.

Second, surround yourself with smart and high integrity people. You learn best in the right environment.

Third, pay close attention to identifying decision makers and influencers for any specific project - sometimes this is obvious, sometimes it is not.

Fourth, work to become a presence. This includes becoming a persuasive speaker and writer.

Fifth, and final maintain a sense of humor and don't take yourself too seriously.

The last point reminds me of a lobbying session with a NJ Congressman. Back in 1997, I walked into his DC office with three priests and a rabbi. Sounds like a setup for a good joke, which is exactly how we began our conversation. Years later, the congressman always remembered me for this exchange. A lesson that may be applicable to many situations, but at least in energy, I always remember to keep it "light."

Women in Energy Story Telling:

Energy in the Blood

Sheila S. Hollis

My earliest memories are of life in the Rocky Mountain West. The mountains, pine trees, the rivers and the blue bright sky imbued in me a love of nature, resources and man's interrelationship with them. My father was a biologist and my mother was a nuclear weapons designer and draftsman. This unlikely combination led me to have multiple interests and intense curiosity about rocks, animals, science and land. My mother had me play under her drafting table at the United States Geological Survey and I learned early about the huge dams, and energy projects she drew.

We moved to Hanford, Washington where she became a nuclear weapons draftsman. Soon thereafter she was recruited to Los Alamos, New Mexico where she evolved into a nuclear weapons designer. Both places were frontier, with great natural beauty. She borrowed a Geiger counter and we explored the arid desert and magical canyons of northern New Mexico every weekend. My father continued work on his doctorate in neuroanatomy with a focus on the brain synapse while my mother and I survived on her remarkable flexibility and talent as an artist and a natural visionary. She was an only child and I was an only child. We were intensely close and were just beginning a long journey of exploration that led me to a career in energy law and policy. After Los Alamos, we moved to Denver and then the high plains of eastern Colorado where she continued her work as geological draftsman in Denver commuting 140 miles daily round-trip. We then moved to Casper, Wyoming where she continued her government work with the Atomic Energy Commission. Finally, we returned to Denver for my high school years.

Because my father and my grandparents were ill, we moved back to Denver and I settled in to downtown life again. In retrospect, I realize that in those eclectic journeys and various living styles, schools, personalities and energy related worlds, that I had been exposed to hydroelectric dams, nuclear weapons design, oil and gas pipelines, oil and gas development and the complex world involving them. Factors included the life of a working mother with all the pressures of professional life, with little fairness or concern for professional working women in the society and a total lack of workplace equality, despite intellectual demands of working in various forms of energy related issues and the need for flexibility and vision. Being a child, I did not realize the tremendous exposure to the world and all of its challenges, foibles and opportunities I was receiving particularly as it affected a working professional mother.

By the time I was 14, my grandfather and father died and my grandmother was in end-stage Alzheimer's and it was just my mother and I together. Mercifully, I had the benefit of many great teachers and mentors many but not all of them Sisters of Charity. Being restless and on my own during the summers, I enrolled in any class I could find that sounded marginally interesting at the local public high school in Denver starting when I was 11. Since I was alone all day in the summers, I just went to school and took classes that may have seemed irrelevant but which have served me well, despite my extremely nontraditional childhood. It is a course of action I would recommend to any lonesome and restless young person. Again, mercifully, I met a boy who was to become my husband and life partner in our inner city Denver parochial high school. As a life

preparation, it was a great and diverse school, with Native American, African-American, Latino, Spanish descent, Anglo, and refugees from Lebanon, Hungary and other countries comprising the student body. I went to the University of Colorado at Boulder, Colorado at 16, focusing on honors classes and literature and journalism. I also worked for three years as a union printer and proofreader and was a stringer and summer reporter for a variety of publications in Denver.

Following undergraduate school I enrolled in the University of Denver College of Law and focused on corporate, international and tax law. It was a particularly difficult time for women graduating from law school. In addition, John, my husband, and I were blessed with a daughter, which was a marvelous complication. In my last months of law school I was offered a job with the then Federal Power Commission in Washington. I'd never been to Washington until the day I disembarked at Dulles Airport and two days later started work. Blessed with a feisty and intelligent boss, who entrusted me with a major case despite being his first woman attorney he has ever worked with over the many year, I was immediately assigned to handle a life-changing case, the spinoff of a huge gas pipeline utility in part of one of the great corporate raids in American corporate history. Thrown into the most sophisticated issues, with the most aggressive and brilliant energy lawyers of the day, I trained on the job in a manner that sent me on a professional journey to this very day. After a very successful conclusion to that groundbreaking case, I became the sole associate of the former General Counsel of the FPC, Richard Solomon, and represented the Public Service Commission of the State of New York during the energy shortage years of 1975 – 77.

At 29, I was recruited to become the first Director of the newly established Federal Energy Regulatory Commission Office of Enforcement. Under the leadership of Chair Charles Curtis, we built an office of 65 professionals in 18 months from nothing. We built a procedural framework for enforcement, which had never existed at the Federal Power Commission, bringing many precedential enforcement actions. Those basic programs and regulations still remains intact today.

After departing FERC Enforcement, for private practice I became involved in major international energy cases and projects including a World Bank contract, and for several years consulted in East Africa, developing the oil and gas code for Ethiopia. Subsequently I worked on many independent power projects and new regulatory laws and contracts around the world. I was asked to lead many delegations of women to China, Argentina, Venezuela, Brazil, Costa Rica and other countries to study and form relationships and invigorate dialogues on issues impacting women in the legal systems of those countries. I also led several energy delegations to the former Soviet Union, Mexico and other nations. During this period major restructuring of the energy industries worldwide, the dawn of concern over climate change, the oil and gas boom and bust cycles all took place. For women in energy it was a great lesson in riding the wave of change, being flexible, learning new policies, programs, laws and concerns and, survivors of disruption and unpredictable changes often emerge, perhaps bruised a bit, but wiser and more capable of evolution professionally and personally. To me, it meant keeping my mind open and my bags packed to seize opportunity, even when it arrives unexpectedly and not in a tidy package.

One of the great experiences of my life was to become the first woman president of the Energy Bar Association: I served as president of the Women's Council on Energy and Environment and the Thomas More Society of America. From 1979 to 1999 I taught energy law at George Washington Law School. I lectured in China, Poland, Mexico, Romania, England, Taiwan, Germany, Canada and other nations on energy, environment, women, human rights and other issues. Recently, I was a delegate for the American Bar Association to the Rio +20 meeting. I've been fortunate to serve on the board of the United States Energy Association, chaired the ABA Section of Environment, Energy and Resources, and was awarded the Lifetime Achievement Award by Platts Energy.

Thus, over four decades my career has centered totally on energy and environment, two inextricably joined arenas, and I been privileged to have lived life in the fast lane as a result of total energy immersion, good luck, an eclectic past and the support of my husband and daughter.

IV. Universal Smart Energy Framework (USEF)

One International Common Standard for a Unified Smart Energy System with Consumers at its Heart

By Jeroen Bode

Putting customers at the heart of our future energy system is essential for its success. Enabling them to play an active role, and rewarding decisions they take that improve efficiency or reduce system stress, are recognised as the best route to a smart energy future. The scope of the new smart energy market has been well publicised and there are already large and small innovators vying for position. With technology ahead of policy, the biggest challenge lies in making sure that all technologies, projects and markets can be integrated, at least cost, and that the end result is a system that optimises efficiency and benefits all stakeholders. The Universal Smart Energy Framework (USEF) aims to achieve this by providing one common international standard for an integrated smart energy future.

More renewables, more system complexity, higher costs

The drive for clean, sustainable and secure energy has led to more of it being produced by renewables of all sizes, from domestic solar panels to large offshore wind farms. As a result, there are more people uploading and downloading variable amounts of electricity, in more diverse locations, than ever before. This has further impacted grid systems that were originally designed to move centrally-produced electricity one way and that are already stretched as demand for, and reliance on, electricity have grown. The increasing complexity of shoring up and managing the energy system in the face of these changes is driving up system costs and making interruption of supply more likely.

There are three key components that make up energy bills and they are intrinsically linked - the cost of the energy used, the transportation of that energy and the costs for operating and maintaining the system. These prices can fluctuate and stress on the system can influence this as it results in congestion, imbalance of supply and demand and, ultimately, volatility of the commodity price of electricity. One way or another, energy consumers pay for all of this and they therefore have a vested interest in solutions which alleviate overall system pain to limit costs in all three areas.

A decentralised model and risk of defection

The advent of smaller, affordable renewables technologies has offered both domestic and commercial consumers the opportunity to become prosumers, generating their own energy to raise income or offset energy bills. In most cases they have been incentivised by governments to do so but the market stimulants in many countries are now in regression. As a result, there is a growing risk of prosumer defection from the energy system. New storage technologies complement their own renewable energy generation. Intuitive, easily accessible apps and smart appliances offer them improved energy optimisation. Combined, these technologies could drive them off-grid since it will be easier for them to control costs this way than remaining connected to, and exposed to the rising costs of, the system - and every defection will effectively increase those costs to other prosumers, potentially perpetuating the problem.

The need to enable and incentivise prosumers

It is clear from both a societal and system perspective that it is better to keep as many prosumers connected to the system as possible. However, while current market designs still offer varying degrees of reward for prosumer renewable energy production, they do not involve the prosumer in market mechanisms. Instead, prosumers remain exposed to contractually fixed retail prices regardless of the situation and so there is little incentive for them to act according to system pressure or market price volatility. Unsurprisingly, this means that the majority continue to produce and use energy however they like because, as far as they are concerned, these things have no perceivable impact on them.

With the energy revolution already underway, ensuring that we arrive at a clean, efficient and affordable shared energy future requires that the power grid and energy markets are made more accessible. Prosumers already have access to energy related information but there is an opportunity to enable and incentivise their active participation in the system. Allowing consumers to make decisions about their energy generation and use would contribute to increasing energy efficiency and reducing overall system pain. Key to putting prosumers at the heart of the market in this way is the need to unlock the value of their flexible energy use.

Commoditising flexible energy use will benefit everyone

By choosing to be flexible about whether to use or when to use energy, prosumers can collectively maximise the efficiency and lower the costs of energy generation, delivery, management and use. Their flexibility has financial value and, with a market for buying and selling it, it could become a new commodity. Prosumers would benefit by selling it for use by grid operators and balance responsible parties who, in turn, would benefit by using it to reduce or change the pattern of overall electricity demand to:

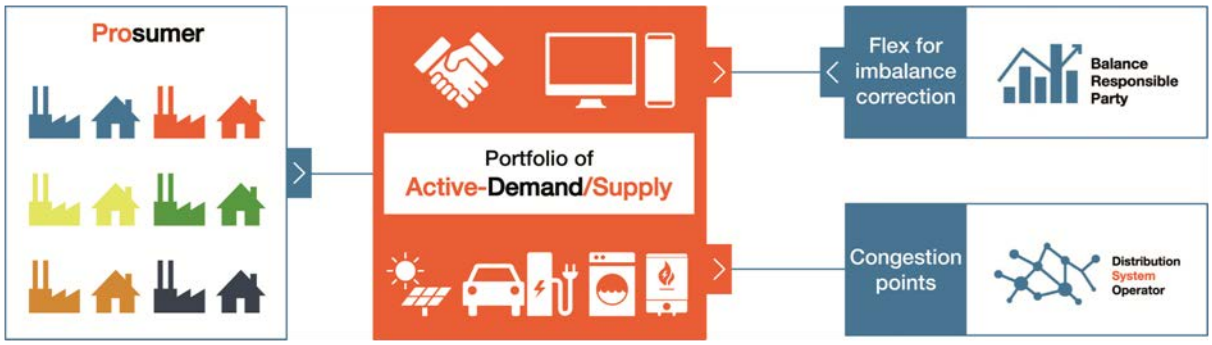
- reduce grid congestion
- avoid expensive grid upgrades
- limit any penalties for failing to balance supply and demand
- avoid buying energy when prices are high

Using flexibility this way would reduce overall system costs, making energy cheaper for prosumers, who would benefit further financially by selling their flexibility. Unlocking this value would revolutionise our energy system by incentivising all parties to play an active role in delivering a more sustainable and cost-effective energy future. Fundamental to achieving this is the need for a specific aggregation function within the market. In fact, the role is considered so important that is has already been part of in-depth discussions at EU level, including within the European Commission's Smart Grid task Force, and is reflected as a necessary requirement within European Commission regulatory initiatives.

The aggregator – a central role

Aggregating flexibility is not new. Many large industrial organisations with high energy requirements already benefit from offering flexibility, for example, by offering to reduce power to cooling systems at certain times, and aggregators sell this on the wholesale market. In order to really deliver smart energy at lowest cost though, the role needs to be extended to aggregate the

flexibility that all energy users and all suitable grid-connected devices can offer. Most of this activity needs to happen in the lower levels of the distribution grid in order to deliver local solutions to local problems. To bring everyone together at this level and, ultimately, connect them to the whole requires robust technologies, systems based on common standards and agreed rules of operation. Above all, the final solution must be cost-effective.



The aggregator role is positioned centrally, between its end customers, who are all motivated to buy or sell flexible energy use because they receive benefits for doing so. The inter-related nature of all parties means that an aggregator's decisions related to one of its customer groups will impact others. For example, if an end-user chooses to offer flexibility to an aggregator and the aggregator acts on that, both that end-users supplier and the person responsible for balancing supply and demand in that end-users area will be impacted. They will have planned for that usage, at a specific time and place and so there could be financial implications for them. Addressing this will require multi-way contracts, transparency of information, and clear rules and processes for communication so that all stakeholders are aware of when they will be impacted, and can receive compensation when they are impacted.

A role for energy experts or retail experts?

Given the complexity and requirement for understanding the energy industry, it is natural to assume that existing energy market players will be the people most likely to offer independent aggregation services. Certainly, they will be interested since it offers a significant commercial opportunity. Functionally, though, it must be a standalone role, unbundled from the sale of electricity so that end-users can make informed decisions to buy energy from, and sell flexibility to, different service providers based on the perceived merits of their offering. Creating a focus on the end-users' willingness and ability to sell the value of their flexibility this way will create the competition necessary to drive investment in, and demand for, energy flexibility services. It will also make the role appealing to organisations that already have strong existing retail relationships and expertise and so it is not hard to imagine a future where we have a choice to sell our flexibility to all kinds of aggregators, from supermarkets to insurance companies.

There may also be opportunities for niche aggregators. For example, a company that currently sells uninterruptible power supply systems to large industrial organisations as back-up in the event of power failure could offer the collective power in its customer units to grid operators. The agreement with its customers to do so could be written into maintenance agreements. It just requires that they are remotely accessible. Likewise, an organisation that leases electric vehicles could offer their collective battery power as storage, or to be drawn on when needed. The opportunities are endless, providing scope for both new and old market participants to create new services.

Pioneers without standards risk reinventing the wheel

With everyone vying for a slice of the smart energy future, there are a multitude of pilot projects underway in multiple locations. There are even organisations that have already started to adopt the aggregator role at some level. The problem is that existing local and national energy markets have different drivers, market structures, roles and legislation. As a result, those already active in the smart energy market are all paving their own way to the future depending on where they are located. This might produce successful individual projects but, while they are not based on a common standard, integrating them all in future will, at best, be costly and, at worst, be impossible. Both scenarios could seriously impact our chances of achieving a truly smart energy future. They would also reduce competition for the aggregators role because of the high costs attached to managing the different contracts, systems and rules in each location and the lack of a guaranteed future opportunity for pan-European or international trading of flexibility.

The Universal Smart Energy Framework (USEF)

A solid foundation for smart energy futures

The Universal Smart Energy Framework (USEF) has been developed to provide a solution to these challenges by delivering one common standard to drive the fastest, most cost-effective route to an integrated smart energy future. It aims to unlock the value of flexible energy use by making it a tradeable commodity and delivering the market structure and associated rules and tools required to make it work effectively. USEF fits on top of most energy market models, extending existing processes to offer the integration of both new and existing energy markets. It is designed to offer fair market access and benefits to all stakeholders and is accessible to anyone internationally.

USEF is developed, maintained and audited by the USEF Foundation, a non-profit partnership of seven organisations, active in all areas of the smart energy industry: ABB, Alliander, DNV GL, Essent, IBM, ICT Automation and Stedin.

USEF at a glance

The market structure comprises specifications which define the roles and responsibilities of each stakeholder, how they interact and how they can benefit from doing so.

A market-based control mechanism ensures the system is optimised based on least cost and maximum efficiency. The processes related to achieving this are also defined.

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The tools include descriptions of basic service requirements, exemplary coding and **a reference implementation** as a standard to build on.	**Privacy & security** are defined to balance consumer confidence with security of supply. USEF complies with the new European General Data Protection Regulation.

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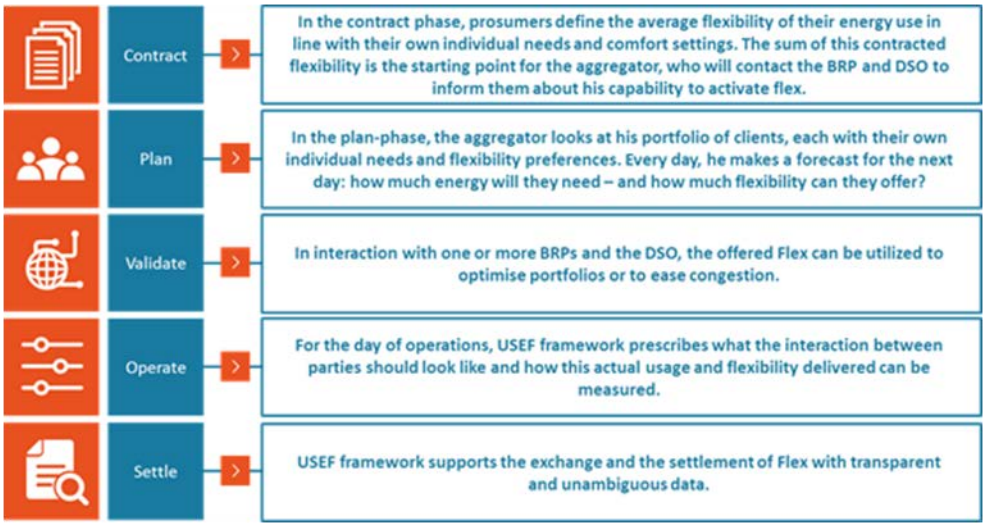
Privacy & security are defined to balance consumer confidence with security of supply. USEF complies with the new European General Data Protection Regulation.

Unlocks flexibility throughout the energy value chain

USEF unlocks prosumer flexibility by ensuring that all stakeholders in the energy system can benefit from its commoditisation. To achieve this, it specifies all stakeholder roles, how they interact and how they can benefit by doing so.

Trading of flexibility is aligned with existing wholesale market models, by extending key processes to include usage prognoses for individual consumers. USEF fits on top of, and can integrate, most market models, therefore building on what exists rather than requiring a whole new market design.

The process for trading flexibility as facilitated by USEF



Connects smart energy products and projects

USEF's open ICT architecture provides the freedom to create unique and commercially competitive smart energy products and services without vendor lock-in. It delivers a common standard on which to build them, ensuring that all technologies and projects will be compatible and connectable to the future smart energy system.

Delivers smart energy market opportunities

The smart energy market will see existing roles adapted and new roles created, some of which will be appealing to all types of organisation, from supermarkets to insurance companies. By defining the individual roles, responsibilities and interactions required, USEF enables interested parties to both understand and realise smart energy opportunities.

Accelerates smart energy transition

By adopting USEF and building on a common standard, projects are more rapidly connectable. Learning is shared, creating a faster route to best practice. USEF's exemplary coding and reference implementation provide the groundwork to accelerate innovation and, ultimately, the whole can be integrated and scaled-up much efficiently.

Reduces costs

By delivering a common standard to build on, USEF reduces the cost to connect different technologies and projects to the energy system. Its market-based control mechanism then defines the rules required to optimise that whole system, ensuring that energy is produced, delivered and managed at lowest cost.

USEF in practice

Pending legislative guidance, the standardisation of market organisation and technologies could facilitate controlled development of the market without hindering innovation. With existing detailed specifications and existing real-life pilots in the market, USEF is perhaps the most comprehensive, advanced initiative of its kind. Two of the USEF-based pilot projects can be found below:

	
Hoog Dalem (link to https://www.stedin.net/over-stedin/projecten/hoog-dalem) A collaborative project in a newly built, all-electric neighborhood in the Netherlands. It demonstrates the financial feasibility of smart energy applications and services to reduce the peak load on the grid. This is done by offering residents a choice of technologies to produce, store and manage energy.	**Heerhugowaard** (link to https://www.stedin.net/over-stedin/projecten/heerhugowaard A collaborative project in an existing residential community of 200 houses. It aims to optimise energy use by bringing gas and electricity applications into competition with each other and providing residents with the technology to make choices about their flexible usage. Is already being used as a basis for other pilot projects and examples of these can be found below.

USEF - Togetherness as an ingredient for success

The USEF Foundation believes that working to one common standard is the most effective route to an integrated smart energy future and that collaboration across organisations, roles and borders is vital to deliver it. USEF was developed, and is being refined, this way and its founding partners work regularly with specialists across Europe to evaluate the framework and deliver a shared goal, for the good of everyone.

Jeroen Bode (1967) is Project Director at USEF. He has held various management functions at Dutch energy supplier Eneco, amongst others responsible for the set-up and operational management of the business-to-business organisation after the liberalisation. Guiding network operator Stedin through its development as high quality network operator in the Rotterdam area, Jeroen Bode was a member of the Stedin board. On behalf of Eneco, and later in his new position as Operations Director at energy consultant GEN (now Energy21), he was closely involved with the establishment of the Smart Energy Collective, out of which USEF was born.

V. How can Regulators Benefit from Independent Ombudsmen and ADR Provide Expertise?

By Marine Cornelis

1. INTRODUCTION

Alternative Dispute Resolution (ADR) is as an out-of-court procedure which aims at enabling consumers to resolve a dispute and obtain a reimbursement and/or compensation for the harm suffered as a consequence of a commercial transaction or practice. This does not cover the direct settlement between a trader and a buyer or internal customer complaint handling mechanisms.[1] EU Directives make clear that the access to such and independent body shall be inexpensive, prompt and fair. Suppliers have to provide consumers with information on how to file a complaint.

The energy sector is a pioneer in the alternative dispute settlement of consumer disputes. The 2009 Third Energy package states that *"Member States shall ensure that an independent mechanism such as an energy ombudsman or a consumer body is in place in order* ***to ensure efficient treatment of complaints and out-of-court dispute settlements.****"* Furthermore, the Directive 2013/11/EU, due for implementation in 2015, requires ADR entities, the wider group to which ombudsman schemes belong, to be available for all business-to-consumer disputes. The Directive will allow for a greater visibility of the functioning of the free (energy) market, and so for better regulatory action and business practice.

Across the EU there are great variations in the dispute resolution environment.[2] In the energy sector, there are 5 independent ADR bodies, 11 schemes as part a body with a larger ADR remit and 14 ADR bodies within a national regulatory authority.[3] In 2010, several of those independent energy ADR bodies established NEON, the National Energy Ombudsmen Network, to promote their activities and analyse their findings at EU level. NEON is an independent European network made up of ombudsmen and mediation services active in the energy sector, which are recognised as independent providers of Alternative Dispute Resolution in their respective countries and regions.

National and regional (regulatory) authorities (NRA) have a duty to help ensure that consumer rights are respected, and that consumers are protected in line with EU law. Here, the question arises as to how independent ombudsmen and ADR entities can work with regulators to enhance consumer's rights?

2. WHAT DO INDEPENDENT OMBUDSMEN AND ADR ENTITIES DO?

ADR helps consumers resolve disputes with traders when they encounter a problem with a product or service that they bought. ADR entities are out-of-court (non-judicial) entities. They involve a neutral party (e.g. a conciliator, mediator, arbitrator, ombudsman, complaints board etc.) who proposes or imposes a solution or brings the parties together to help them find a solution. Some of these entities operate fully online and are called online dispute resolution (ODR) bodies. ADR and ODR are usually low-cost, simple and fast procedures and are therefore beneficial to both consumers and traders, who can avoid court costs and procedures. ADR and ODR are not internal customer complaint services run by traders.[4]

Policy makers acknowledge that consumers and citizens need to feel safe to engage in any market. Trust implies a high level of protection through transparent, efficient, and fair procedures followed by all stakeholders. Without the full enforcement of energy consumers' rights, including the right to send a complaint to an independent body for an out-of-court dispute settlement, such as an energy ombudsman, consumer engagement remains limited. In the energy sector, this right is ensured by the Third Energy Package (2009), and also by the cross-sectoral Directive 2013/11/EU on alternative dispute resolution for consumer disputes.

Active in the energy sector, independent ombudsmen and ADR bodies, members of NEON, the

National Energy Ombudsmen Network, are impartial. They are not consumer organisation, but their operations lend the voice of the consumer equal weight when resolving disputes between energy companies and consumers, resulting in decisions which are not biased in either direction.

Members of NEON are independent ADR bodies that respect principles of fairness, with no discrimination, focus on the right to good administration, and pay special attention to vulnerable customers.[5] Further, ombudsmen promote and guarantee human and fundamental rights. Hence, they have the flexibility to use a wider number of [legal] tools to help consumers. NEON members can highlight malpractice and significant breaches of business ethics, for example.

Independent ombudsmen build their moral authority on formulating recommendations towards for companies, regulators and policy-makers. They can provide feedback through their expertise and complaint data gathered about the market. Some ombudsmen have the possibility to launch investigations on their own-initiative. They can identify systemic problems and propose solutions to improve the service provided to all citizens, all consumers, not just to those who turn to the ombudsman for help.

3. BUILDING TRUST IN THE MARKET: WORKING TOGETHER TO (RE)BALANCE THE ENERGY MARKET

EU legislation, especially through the Third Energy Package, requests national regulatory authorities (NRAs) to be wholly independent from the interests of the energy industry and their job is to ensure the thriving and efficient functioning of the market. NRAs are independent market watchdogs, and some are also entitled to act as a dispute settlement authority in certain cases.

Even though this article does not aim to discuss the choice to deliver ADR through a national regulatory authority or through an independent scheme, it is important to highlight some conclusions of academic examination. Research from the University of Oxford (Creutzfeldt and Hodges) [6] highlighted that ADR delivered through an independent body deliver better outcomes than when it is done by the regulator itself. The focus, public profile and public understanding of a regulator are simplified where the roles of regulation and dispute resolution are kept separate. Creutzfeldt and Hodges both point to the experience of the German energy ombudsman. [7] Their research found that consumers feel more confident to approach an ADR body that is clearly separate from both the company complained about and from the regulator. Nevertheless, delivering ADR through a national regulatory authority might facilitate flows of information and market insight to underpin effective regulation. It would also tend to promote consistency between regulatory direction and redress, affording the regulator with another lever to measure and, where necessary, to challenge and correct behaviours within the sector.

The work of independent ombudsman schemes, such as NEON members, goes beyond dispute resolution and beyond regulation. Ombudsmen are autonomous observers and through complaints and dispute data management, they act not only as whistle-blowers but as advisory supports for policy makers and regulators.

On the one hand, the compiling of disputes and complaints data gives the individual consumers' voice weight in a situation where it would usually be drowned out by large energy companies. The individual consumer benefits from an ADR body by being heard in the imbalance of powers between the consumer and the business. Ombudsmen are enabled to provide strong and trustworthy sources of information for consumers. In France for instance, the Ombudsman manages an information point for consumers. In Great Britain consumers can introduce a dispute by phone and a written transcription is sent to the company.

On the other hand, regulators need ombudsmen's feedback in order to understand the market better, its systemic failures and the main challenges consumers face. NEON members publish annual reports with detailed data about the complaints they receive. However, this is only part of the picture, as research shows that only a fraction of potential complaints get to the independent redress body. [8] Ombudsmen have the ability to empower consumers through the provision of information to the stakeholders.

An ombudsman has a specialized appreciation of the energy market thanks to his power of investigation, and takes into account all regulations and legislative framework. The ombudsman also takes market practices, contractual terms, and the respect of consumer protection into consideration. In general, a regulator will look at the organisation of the market, the legal and technical control of Distribution System Operators (DSOs), the monitoring of prices, while an ombudsman looks at individual situations. The work of ombudsmen is more than conciliation, as they try to find a solution or an arrangement that satisfies equally both parties.

It is also important to note that the ombudsman's work is considered as reliable from the companies' point of view. Data on complaints and dispute resolved may highlight their good or poor performances. Ombudsmen and ADR bodies provide them with feedback on the types and numbers of complaints received and handled, which gives companies the opportunity to improve their services and offers. Suppliers and DSOs do trust the ombudsman's processes and tend to show more involvement toward consumers.

Last but not least, ombudsmen also receive and provide important inputs to regulators, especially regarding market practices of the suppliers and DSOs and regular meetings are held to discuss and improve the organisation of the energy market.

Energy Union's New Deal for Energy consumers is accompanied by innovative energy services (bundled offers, smart technologies, self-generation and consumption, and collective actions etc.), which need specific knowledge of consumer activity. Ombudsmen and independent ADR providers, with the help of consumer associations and NRAs, seem best placed to provide this and will establish a strategy to anticipate those challenges.

Ombudsmen and independent ADR providers should be empowered all across Europe to address cross-sectoral challenges and enable stakeholders, including consumer and welfare organisations, suppliers, DSOs, regulators and policy makers, to get a clear understanding and to take the necessary measures to protect and empower consumers.

4. BETTER UNDERSTANDING OF THE MARKET MEANS BETTER REGULATION: EXAMPLES OF POLICY MEASURES

A. BELGIUM

In Belgium, the energy ombudsman acts as the single point of contact for energy-related complaints. An agreement has been signed with the federal administration and all the Belgian regulators to define the dispute handling processes and the diffusion of information. The energy ombudsman receives and provides regulators with important inputs, especially regarding market practices of the suppliers and DSOs and hold regular meetings to discuss and improve the organisation of the energy market. Regulators, the ombudsman and other public services gather twice a year for the permanent consultation group.

The Energy Ombudsman Service has advisory powers towards the government. Hence, he has been involved in the drafting of the New Consumer Agreement protecting "The consumer in the liberalised electricity and gas market". [9] This Agreement protects (residential) ends-consumers, and compliance with the provisions of this agreement constitutes fair trade practices towards consumers.

Some new provisions of the Consumer Agreement are based on suggestions and recommendations from the Belgian energy ombudsman. Hence, each year, the supplier has to propose the cheapest tariff option; the extension of contracts can't be at the consumer's disadvantage; otherwise the consumer has the right to terminate their energy contract without termination fee or preliminary notice; the supplier can no longer ask for termination fee when switching supplier, even when the change takes place after moving; price simulators are becoming more transparent; the moving process is improved; customer can decide to exclude the annual bill from the direct debit plan; and suppliers have to pay interests in case of late credit repayment.

At the end of 2014, the ombudsman provided the federal Minister of Energy with a memorandum containing several proposals, identified by shortcomings in the energy market observed by the ombudsman since its establishment in 2010. The ombudsman recommended a wider access to the right to the social tariff for electricity and natural gas. This would enable 1 million vulnerable families to benefit from an affordable energy price, which corresponds to the number of families living below the poverty line in Belgium (20% of families in Belgium). It also recommended an improvement of the Consumer agreement and its extension to SMEs (end users with an annual consumption of max.100.000 kWh gas and max. 50.000 kWh electricity); while doorstep selling of energy contracts to residential customers and SMEs should be banned. The ombudsman called for uniform, legible energy bills so that the residential or business consumer might be even better able to evaluate and compare prices, tariffs and agreed invoiced reductions. The safety net regulation mechanism for variable energy prices to energy products with a fixed energy component was also asked to be extended.

B. CATALONIA

Every year, the Síndic (ombudsman) informs the Parliament on his work. He also presents special reports on important or urgent specific issues. These public reports also contain recommendations regarding consumer protection. In 2013, the Catalan ombudsman decided to take an ex officio action to report on energy poverty. The report, issued in October 2013, identifies energy poverty, defined as the difficulty to afford basic utility bills (electricity, gas and water) as a growing social phenomenon, albeit difficult to quantify. In this report, the ombudsman sees shortcomings in public energy poverty policy, to allow the Generalitat (Catalan autonomous community) to approach this growing problem in a holistic, multidisciplinary and coordinated way.

One of the proposals was to set up a “winter truce” consisting of the non-interruption of supplies for non-payment during the winter period for those people in a situation of poverty. Furthermore, the ombudsman encourages the supplying companies to reach agreements with affected people so that they can make the total annual payment or only those invoices corresponding to the winter period in instalments throughout the rest of the year. In addition, the Catalan ombudsman proposes that the interruption of supplies be limited to persons or families with an income below the IRSC (indicator of sufficiency of income).

Following the issuing of the report, the Catalan Government approved a decree in December 2013 to avoid cutting off energy supplies to families in need during winter months. The task of the Síndic, together with other stakeholders, played an important role in this innovative legislation, as was the first time that any authority in Spain passed such a regulation.

In addition to this, in December 2014, the Síndic published a Report on the Right to Basic Utilities (Electricity, Water and Gas). [10] This report analyses current shortcomings in the field of energy poverty and basic utilities and contains a number of proposals to reduce the vulnerability an increasing number of persons face.

C. FRANCE

In 2014, the review of the Draft Energy Transition Law was an opportunity for the ombudsman to put forward proposals that he had been advocating for a long time, in order to make the “right to energy” a reality for every French inhabitant. [11] This right involves the need to simplify and expand assistance for the payment of bills. Acknowledging that social tariffs did not work well (poor number of households reached despite automation, lack of support for users of domestic fuel or wood), the ombudsman argued in favour of an energy voucher (Chèque énergie). This voucher will benefit all domestic energy sources, and replace the current social tariffs for electricity and natural gas.

Other proposals of the ombudsman received a good response from the Parliament, such as the establishment of a supplier of last resort, limit back billing to one year (14 months in the final version), align leasehold winter truces and energy or to equip households with a remote display to help them manage their energy consumption. Alongside consumer associations, the ombudsman was able to influence a text on technical measures, aimed at achieving the broad objectives of the energy transition. Thanks to the ombudsman, Article 1 of the draft law makes the fight against fuel poverty a goal. A universal right of access to energy was affirmed. Consumers, who will be one of

the pillars of the success of the energy transition, are better taken into account. Nevertheless, the proposal to get a supplier of last resort, the guarantor of the right of access to energy, has not seen the light of day.

D. GREAT BRITAIN

In Great Britain, the Gas and Electricity markets authority, acting through the NRA Ofgem, operates a licencing regime for suppliers. Its 2012 Guidelines include sanctioning for breaches of licences or licence conditions. Customer complaints are required to be handled by companies under strict standards within eight weeks and shall then be referred to the ombudsman. [12] Furthermore, the watchdog Consumer Futures can investigate complaints from consumers if they are of wider public interest, even though it has no legal powers to secure redress on their behalf.

In 2015 [13] Ofgem made the decision to refer the energy market to the Competition and Markets Authority for full investigation. Ombudsman Services offered their assistance by providing evidence at the hearing and received thanks for the information provided. Ombudsman Services are also regular participants in Ofgem led events and have contributed to Smart Energy GB events, providing an insight to current complaints and expectations for the smart meter roll out. In addition to this, Ombudsman Services continually work with suppliers on an individual basis to drive improvements within the industry.

Ombudsman Services also works with Energy UK, the trade association for the energy industry, and other industry bodies to share knowledge about consumer complaints and encourage improvements. Ombudsman Services engage with consumer groups and they attended the National Energy Action (NEA) Fuel Poverty for England event to discuss the consultation on a new fuel poverty strategy and how to help support fuel poor households. Ombudsman Services has ongoing meetings with the Extra Help Unit and Citizens Advice to look at the ways suppliers support vulnerable energy customers.

E. CZECH REPUBLIC

In Czech Republic, a central authority of state administration has been appointed as the alternative dispute resolution body for energy, called the Energy Regulatory Office. It carries out this activity on the basis of an authorisation given under the Energy Act. Furthermore, the Energy Regulatory Office has also been appointed as the alternative dispute resolution entity for consumer disputes on the basis of a bill on consumer protection. This bill is currently being debated in the Parliament of the Czech Republic. However, no separate law provides for the position of an independent energy ombudsman.

Nevertheless, from 1 February 2014, the Energy Regulatory Office set up the position of an energy ombudsman as an alternative dispute resolution entity for consumer disputes in the energy sector and as a sort of a stepping stone towards an ADR entity for consumer disputes, appointed under Directive 2013/11/EU on alternative dispute resolution. Despite the Energy Regulatory Office's efforts, the position of an independent energy ombudsman as an entity for out-of-court resolution of consumer disputes in the energy industries has not been provided for in any amendment to the Energy Act or the bill to amend the law on consumer protection.

Since the internal energy ombudsman was appointed, the cooperation between the regulator, i.e. the Energy Regulatory Office, and the ombudsman has been exemplary. The Energy Regulatory Office has put in place for the ombudsman all the prerequisites for the performance of the ombudsman's work, including the deployment and financing of additional employees in the ombudsman's department, who work on out-of-court dispute resolution. However, without support provided for in a law, the Energy Regulatory Office's internal energy ombudsman has no decision-making competences, and he has been resolving disputes through negotiation, i.e. conciliation. It is true, though, that in a number of cases, energy suppliers have accommodated the ombudsman's opinion although it is not their duty.

5. CONCLUSION

Independent energy ombudsmen give advice to their respective governments, parliaments, regulators, consumer organisations and markets operators to improve the consumers' understanding of the energy market. This covers consumer protection, social measures and energy efficiency improvements. They work in close partnership with consumer and social welfare organisations in order to create and encourage synergies.

Dr Naomi Creutzfeldt (University of Oxford) discussed, in a report published in March 2015 on the state of play of ADR in the energy sector, that all Member States (at national or regional level) have a body that is responsible for dealing with energy complaints, but there are great variations in the set-up of these bodies. Member States are at different stages of the implementation of the Third Energy Package and the consumer ADR directive.

To achieve the goals of the Energy Union, the EC should ensure the full completion of the Third Energy Package, and carefully monitor the implementation of the ADR directive. Consumers, policy-makers and regulators alike will benefit from the enforcement of the ADR directive. Consumer rights will be more respected, trust in the market will increase and therefore consumers across Europe will be more likely to engage.

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VI. Realising the Potential of Guarantees of Origin to Empower Consumers

Increased Environmental Awareness & Accountability in Electricity Purchasing

By Markus Klimscheffskij, Dirk van Evercooren and Phil Moody

1. INTRODUCTION

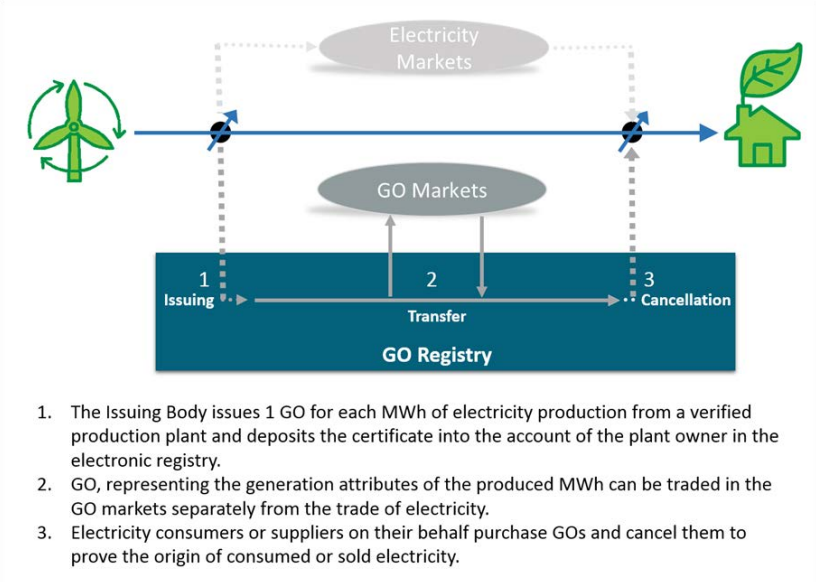
1.1 Guarantees of Origin and Electricity Disclosure

Throughout the world, the importance of energy- and climate-related issues is rising markedly; particularly those relating to clean and efficient energy production. Policy instruments which enable the source of energy to be tracked and disclosed to consumers will play a key role in the transition towards a sustainable future, which is the goal of the EU's Energy Union and of the EC's Citizen's Energy Forum: "*Electricity flows to our houses and businesses from a mix of sources from all the power stations that are connected to our power system*". [1]

Guarantees of Origin [2] (GOs) help consumers make an informed choice about the origin and environmental impacts of their electricity supply. They help us overcome the physical impossibility of tracking electricity across the power grid, and do so more efficiently and reliably than tracking systems based on contractual arrangements. [3]

In brief, GO systems work like this: [4]

1. GOs are issued by national Issuing Bodies against verified production by power plants, and placed in the producer's account in that country's electronic GO registry.
2. Issued GOs may then be transferred to other Account Holders, independent to the transfer of the associated electricity, so exchanging ownership of the underlying production attributes. Within Europe, GOs may be transferred internationally between national GO registries through the Association of Issuing Bodies (AIB) Hub, which is available to countries adhering to the European Energy Certificate System (EECS).
3. Finally, GOs are cancelled (used) by electricity suppliers (sometimes directly by large consumers) to verify the origin of electricity. Under Directive 2009/72/EC Art. 3(9), electricity suppliers must inform their customers of the energy origin and environmental impacts of the electricity sold, and this "Electricity Disclosure" (hereinafter referred to as "Disclosure") is the sole purpose of GOs. In most AIB member countries, GOs are the only means of selling renewable electricity to consumers.



1. The Issuing Body issues 1 GO for each MWh of electricity production from a verified production plant and deposits the certificate into the account of the plant owner in the electronic registry.
2. GO, representing the generation attributes of the produced MWh can be traded in the GO markets separately from the trade of electricity.
3. Electricity consumers or suppliers on their behalf purchase GOs and cancel them to prove the origin of consumed or sold electricity.

Figure 1 GO Lifecycle [5]

Hopefully, the forthcoming revision of the RES Directive will enhance the GO system: the infrastructure has matured and can support policy changes to improve the ability of the GO system to empower consumers and promote clean energy.

1.2 This Article

The next chapter explains how the debate prior to the last Directive focussed on the use of GOs for support and target accounting. Although important, this overshadowed discussion of other important issues regarding the use of GOs for Disclosure. The forthcoming revision of the Directive must address these, if GOs are to achieve their full potential.

There are four key challenges for the current GO system:

1. Most GOs are issued for renewable electricity, but Disclosure mostly refers to non-renewable electricity. This makes the overall Disclosure scheme unreliable and creates an unlevel playing field for market participants.
2. GOs do not include information about the underlying CO2 emissions and produced radioactive waste, although this information must be disclosed to consumers and is important for making an informed choice. This makes the rules for Disclosure of environmental impact information of electricity use both unreliable and unharmonised.
3. GOs and Disclosure are addressed in different Directives, and rules for Disclosure include significant national variance due to lack of Europe-wide regulation. The GO system is successfully internationalised, but the market cannot be truly international until the rules for Disclosure are harmonised.
4. Quality labels are not yet an inherent part of the green electricity marketing system supported by GOs. Their inclusion could help the public and relevant stakeholders to understand the system better.

This article addresses these challenges with the intention of:

- creating a level playing field for renewable, nuclear and fossil power
- empowering consumers to control the environmental impact of their electricity
- fostering GO market development by harmonising national rules, and enforcing the role of quality labels as a critical add-on to the “basic” tracking done by GOs.

1.3 Historical Synopsis of the Birth of GOs

The birth of GOs as an electricity tracking mechanism was preceded by protracted political debate; and their role and purpose was unclear until Directive 2009/28/EC gave them their current sole purpose: to support Disclosure.

Approval of the first Internal Energy Market Directive in 1996 motivated electricity suppliers to differentiate their products. Certificates (such as GOs) became the preferred way to disclose electricity from renewable energy. The first legislative framework for GOs was provided by Directive 2001/77/EC, but its provisions concerning GOs were vague: though preamble 10 set GOs as an electricity tracking instrument, the Directive did not state clearly whether GOs were for measuring attainment of national targets, or for something else. Furthermore, the Directive which regulated mandatory Disclosure of the source of electricity by suppliers (2003/54/EC) did not directly link this to GOs.

The obscurities created by Directive 2001/77/EC were further confused by consideration of an EU -wide harmonised support scheme for renewable energy, and the contending types of scheme: feed-in tariffs and tradable green certificates. Those in favour of an EU-wide support scheme, saw GOs as a flexible way of measuring target compliance, justified by efficient use of resources and fair burden sharing.

A new Commission proposal in January 2008 allowed Member States to opt out of GO trading, but the Parliamentary reading of the proposal led to increasingly negative opinion, especially concerning the use of GOs for support, disclosure and target accounting. The proposal was therefore amended to introduce transfer of renewable energy solely through separate, tradable Transfer Accounting Certificates. This was rejected in June 2008 due to the perceived administrative burden. Finally, the role of GOs in target compliance was rejected in December 2008. This was upheld in the approved Directive 2009/28/EC, separating GOs and target compliance, and setting the sole function of GOs as tracking electricity generation attributes for Disclosure. [6]

As the debate mostly concerned the purpose of GOs, many important details regarding their use for Disclosure were left for national subsidiarity.

1.4 Current status of GOs

GOs and Disclosure are now established, reliable processes, at least among AIB member countries. GOs are issued under the EECS [7] standard for over 300 TWh per annum (30% of EEA and Switzerland) of renewable electricity production. This is particularly impressive, as not all RES production is eligible for issuing due to: 1) regulatory restrictions concerning electricity receiving public support, 2) national GO systems outside of EECS, and 3) not all countries adhering to EECS.

EECS encompasses roughly 60 % of the available renewable electricity, and this is rising rapidly as EECS is adopted by new countries. The development and implementation of EECS has led to several important achievements:

- The creation of an efficient, accurate, reliable and transparent tracking mechanism for GOs through standardisation. This led to international initiatives for quality labels based on EECS;
- Promotion of international recognition of GOs, providing an important contribution to the European market for renewable energy; and
- Continuous growth of the GO market, providing consumers with efficient access to increasing volumes of renewable energy.

2. Challenges

2.1 All Electricity Consumption should be covered with GOs

While Art.15 of Directive 2009/28/EC created GOs as the primary method for Disclosure, most Disclosure relates to non-renewable energy. AIB statistics show that in 2014, GOs were cancelled for 332 TWh of electricity consumption, representing 15% of the total electricity consumption of AIB members.[8] This figure is lower in countries which are not AIB members.

The relatively small market penetration is due to the issue of GOs mostly being restricted to electricity production from renewable energy. This leaves a large unknown in Disclosure, as suppliers must establish the energy origin of the remaining 85% in other ways.

Therefore, GO systems solely addressing renewable energy cannot deliver fully reliable or even meaningful Disclosure information, as most Disclosure would still be based on uncorrected statistics or self-declarations. Renewables also bear most of the cost of electricity tracking and disclosure systems, reducing their ability to compete equally with fossil and nuclear production, which are mostly tracked with little or no regulatory oversight.

Currently, the dominant method of determining the remaining energy origin is by the “residual mix” calculation. However, it is calculated at country level, leaving all suppliers with the same energy mix for the untracked part of their electricity supply, so most consumers in a country have to make do with a homogenous mix. This neither supports supplier differentiation nor does it support consumer empowerment. Only a system that explicitly tracks all electricity will actively encourage all consumers to pay attention to the origin and environmental impacts of their electricity. The use of GOs to disclose the origin of all electricity to consumers would be a logical and efficient enhancement of transparency and further empower consumers.

Besides failing to address the majority of supplied electricity, residual mix calculation also entails more inaccuracies than a system where all Disclosure is based on GOs. This is due to complexities introduced by exchange-based trades and calculating the net effect of swap contracts. Market coupling has further complicated this. Hence most electricity tracking occurring outside of the GO system (or national support schemes) cannot be accounted for in the residual mix due to lack of transparent information. Therefore, this is inherently double-counted.

Extending issuing of GOs to all energy sources would share the administrative cost of the disclosure system between more market parties, significantly lowering the unit cost. The marginal cost of issuing GOs for nuclear and fossil sources is relatively small, as the GO system infrastructure is already in place and EECS has been designed to support all energy sources, so there are no development costs. Further, the number of fossil and nuclear production devices is relatively small compared to those using renewable energy, because the unit size of fossil and nuclear plants in MW is larger, so their administration is simpler. It is safe to assume that existing reporting to regulatory bodies already fulfils the requirements for issuing GOs for these plants.

Placing nearly all of the cost of the Disclosure system on renewable producers is disproportionate, as this is a small part of the overall market. Furthermore, the overall system cost may even decrease if GOs were issued for all energy sources, as this would greatly simplify the calculations and - provided the usage of GOs became mandatory for all energies - would eliminate the need for residual mixes.

A Disclosure system fully based on GOs supports and reflects the recent CEER Advice on Customer Information on the Sources of Electricity, [9] as well as the Best Practice Recommendation 11 [10] of the Reliable Disclosure Systems for Europe (RE-DISS) Project. The absence of mandatory GOs for all sources of electricity means there is no complete picture of electricity supply across Europe. [11] Clearly, if Disclosure was solely based on GOs, the system would be more reliable and meaningful, and would better promote consumer choice. Where required, this could be supported by statistical allocation of household and similar small-scale production and electricity under support schemes, provided these are also used in association with Disclosure.

2.2 GOs should Make Consumers Accountable for Environmental Impacts of their electricity

As long as GOs do not carry the value of associated carbon emissions and radioactive waste, or otherwise enable this to be accessed, perhaps the most critical link between Disclosure and GOs is missing: according to Art. 3(9) of Directive 2009/72/EC, suppliers should inform their customers of the content of carbon emissions and radioactive waste in sold electricity, yet neither carbon emissions nor radioactive waste is included in the information content required on GOs by Directive 2009/28/EC; nor does it enable it to be easily derived.

Clearly, consumers will not find it meaningful to purchase windpower products if their carbon content relates to the overall generation mix: windpower emitting CO2 would make little sense to consumers. In particular, large consumers wish to acquire reliable information regarding carbon emissions associated with the electricity they are using, so they can calculate carbon footprints for their Corporate Social Responsibility statements.

Reliable tracking of electricity - and therefore the associated carbon emissions and radioactive waste - is helpful in supporting consumers' ability to take responsibility for the environmental impact of their electricity consumption. Furthermore, the use of GOs to track carbon emissions resulting from the associated electricity production clearly makes it easier for the public to understand the GO system, and could lead to its greater acceptance and use.

As GOs do not carry information on environmental impact, tracking of environmental values can only be done by associating GOs with reference values - in an unregulated arena that is poorly harmonised across Europe. The values vary from company to company, and ignore aspects of carbon emission calculations such as life cycle assessments. This should be harmonised, not least because the 'industry-standard' Greenhouse Gas Protocol Scope 2 Guidance [12] explicitly refers to GOs as the mechanism for market-based carbon footprinting in Europe. It is important to track carbon values reliably and consistently; and to ensure this by implementing the GHG Protocol Scope 2 Guidance.

To accurately and reliably implement Directive 2009/72/EC, GOs should provide the basic information needed to calculate the emitted carbon and generated radioactive waste arising from the underlying electricity production. The Directive could contain – or refer to - principles for calculating carbon emission and radioactive waste values, either as an annex or as a set of guidelines. If GOs were to record carbon emissions according to a Europe-wide set of rules, this would enable traceable and reliable calculation of the carbon emissions arising from electricity used by consumers – from households to energy-intensive industries. [13] This would make the GO system more meaningful and attractive for consumers, and links well with the EU 2030 federal target on carbon emission reduction.

2.3 Harmonisation of National Rules

While the EECS has successfully harmonised the rules for GOs in much of Europe, the rules for Disclosure still differ from country to country; creating market barriers, lack of liquidity, arbitrage, loss of disclosure information and (most importantly) double-counting.

GOs and Disclosure belong together because Disclosure is the sole purpose of GOs. [14] Hence it would be most efficient and coherent if GOs and Disclosure were set out in a single piece of legislation, rather than in three different Directives. [15] It is especially unfortunate that Directive 2009/72/EC does not refer to GOs: the separation of GOs from their purpose, Disclosure, has been a major cause of the problems experienced by today's GO and Disclosure systems. [16]

The following paragraphs list some of the primary issues which need to be addressed if Europe is to successfully implement a common electricity market (the two most important issues are briefly elaborated - the list is not exhaustive):

• **Suppliers should not be able to disclose the origin of the same electricity twice**

Art. 3(9) of Directive 2009/72/EC requires electricity suppliers to disclose to consumers their overall fuel mix for the preceding year. Most countries complement this by adding information on the specific product (e.g. windpower) supplied to that consumer. The "product information" has been added following demand by consumers, who are usually more interested in what energy they are buying than what is sold in aggregate by their supplier. Where product information is provided to consumers, such products must be excluded from any sales to other consumers by the same supplier [17]: failure to do so will lead to fuel being declared in both the default mix and in products (see figure 2: "Product and Supplier Mix").

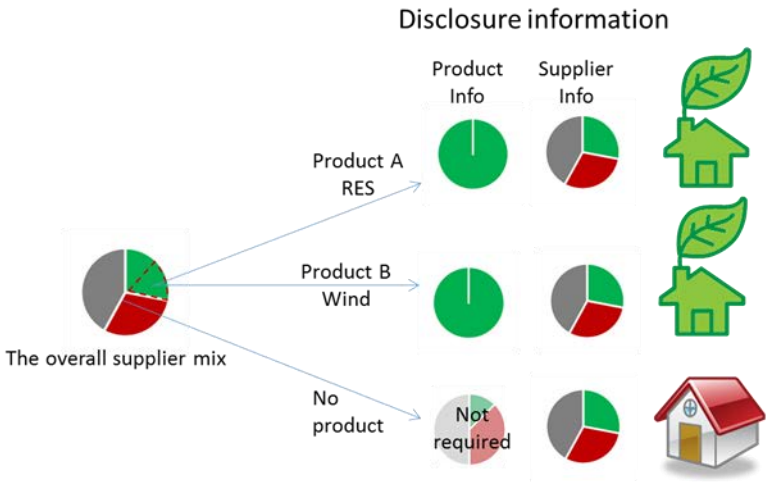


Figure 2: Product and Supplier mix

• **GO Timeframes and rules for eligibility for Disclosure should be harmonised**
The Directives do not impose deadlines for using GOs to disclose the source of a specific year's Electricity, and so a voluntary deadline of 31st March for GO cancellations for the previous year's Disclosure is recommended by RE-DISS (recommendation 34)[8]. However, this has not been adopted in all countries, which acts against the interests of the Internal Market.

Furthermore, Directive 2009/28/EC provides a lifetime for GOs of 12 months after production
of the associated electricity, but does not regulate whether GOs representing generation attributes of one year should be eligible to be used for disclosure in another year. Nor does it
regulate whether GOs can be used in advance for future consumption periods which are within their lifespan.

•Supported electricity should receive GOs in all countries.
•Transparency over GO market transactions should be increased, following the example of European electricity and gas markets.
•Only one GO should be issued for Highly-Efficient Cogeneration (HEC); and the GO should provide evidence of both the source and technology (HEC) of the production.
•Countries should harmonised rule for assessing the recognition of GOs.
•Energy sources in disclosure statements should be harmonised.

2.4 Quality Labels

Environmental NGOs and consumer organisations are sometimes unwilling to endorse the possibilities that GOs offer, perhaps because they do not yet understand their nature and benefits. Also, GOs are often thought to represent average European renewable energy production, whereas they are actually information-rich and can enable very detailed product differentiation. They need to be marketed more effectively.

High-quality GOs could carry a “gold” mark to simplify differentiation, and enable consumer organisations to recommend only such GOs. EECS offers the facility for tagging GOs to demonstrate that they qualify according to the criteria set by labels such as EKOenergy and Naturemade and TÜV SÜD Generation EE; and sustainability criteria such as ISCC and NTA8080. [18]

Furthermore, the Commission might require member states to insist that electricity suppliers make the source of energy clear, so that consumers can exercise choice. This is especially important in countries with a high share of renewable energy, where consumers instinctively assume their energy is renewable without bothering to confirm this by looking at their electricity bill. This requires legislation; and the support of environmental NGOs, consumer organisations and suppliers.

It is vital that each of these parties is made fully aware of the benefits of a harmonised Disclosure system backed by GOs compared to other alternatives; and that the opinions of each of these parties taken into account by the revised Directive.

3 Summary

AIB is committed to supporting active consumer choice through reliable information. Progress towards a sustainable, low carbon Europe is only possible if people as consumers, voters and tax -payers are involved and committed: GOs enable everyone to become conscious of the impact of their electricity purchases on the environment. Indeed, the political value of GOs to their ability to empower consumers could be more important than any monetary incentive they provide to clean technologies.

Consequently, we endorse the Commission’s intention to empower European consumers by providing more choice in an integrated, competitive European energy market; and providing them with greater energy security and reduced carbon emissions.

The proposed enhancements to the GO system arising from revision of the Directive include:

1. **Involving and empowering consumers in renewable energy policies**

   AIB promotes a future Disclosure system which confirms that Disclosure is the sole purpose of GOs, and bases Disclosure solely on information from cancelled GOs.

   This would allow consumers to be made individually responsible for the quality of their electricity; and level the playing field for renewables by spreading the burden of the tracking system across all energies.

2. **Allowing consumers to control the environmental impact of their electricity use**

   Using GOs for carbon accounting would reinforce the primary task of GOs in supporting RES, and empowering consumers to take responsibility for the carbon content of their electricity. Furthermore, reliable disclosure of such information is required by Directive 2009/72/Art.3 (9).

   The use of GOs for disclosing to consumers the carbon emitted in producing their electricity may also lead to greater acceptance of delinking GOs from the associated energy, as consumers should find it easier to understand and accept the accounting system offered by GOs if it provides the basis for the carbon accounting associated with purchased electricity.

3. Fostering market growth through harmonised rules

While Directive 2009/28/EC (supported by EECS) provides an elaborate European framework for GOs, the rules for Disclosure are far less unified. This can lead to market imperfections including barriers and double-counting [19], damaging the reliability and reputation of the entire Disclosure system.

4. Increasing awareness of Disclosure and environmental impacts through use of labels and cooperation with consumer organisations

Typically, suppliers in countries exporting GOs downplay the effect of exports on the origin of electricity sold, and instead refer to the national production mix. This makes the GO system even harder for consumers to understand.

The awareness of Disclosure systems could be significantly improved by clearly regulating what needs to be disclosed to consumers, and emphasising the role of GOs as the sole permitted disclosure mechanism. Furthermore, quality labels should become an inherent part of the GO system as a means of applying additional criteria.

With the proposed changes, we believe GOs can:

- Further strengthen consumer empowerment by RES policies;
- Provide a meaningful and mutually-supporting link with European carbon emissions markets, and therefore help decrease carbon emissions; and
- Lead to harmonised rules of Disclosure across Europe, paving the way towards Energy Union.

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(http://there100.org/action)

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Markus has 7 years' work experience in the energy sector, 5 of which in the field of energy certificates and electricity disclosure at Grexel as a senior consultant and client manager. Markus currently holds the position of Chairperson in the Working Group Internal Affairs of the Association of Issuing Bodies (AIB) and has been heavily engaged in the RE-DISS I and II Projects (Reliable Disclosure Systems for Europe) with the main task of calculating European residual mixes.

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As Director Markets at the Flemish Electricity and Gas Regulator, Dirk van Evercooren directs developments of the electricity, gas, renewable certificates and guarantees of origin markets. This includes gathering and publishing data, surveying end-user experiences, developing contacts with market parties with regard to the structuring of market mechanisms, controlling compliance with regulatory guidelines, organising the energy market and data exchange model and so on. His work at VREG also allows him to take up several other very interesting mandates, such as President at the Association of Issuing Bodies and Chair of the CEER Customer Empowerment Task Force.

Phil Moody

Phil Moody helped found the Association of Issuing Bodies, becoming its secretary general in 2002. The AIB represents European certificate system administrators and is the leading enabler of international energy certificate schemes through its European Energy Certificate System (EECS) and its inter-registry telecommunications Hub, which enables simple, secure and efficient transfer of guarantees of origin (GOs). Last year, the AIB's 23 members transferred 246m GOs internationally. He is responsible for administering and developing the Association, and was a major contributor to the development of the CEN/CENELEC standard for GOs.

VII. The WACC model in the regulation of the Norwegian electricity network operators

By Tore Langset and Silje Catherine Syvertsen

Abstract

In this paper we describe the former and the current cost of capital model used by the Norwegian Water Resources and Energy Directorate (NVE), the national electricity market regulator, when regulating the electricity network operators. The financial crisis had durable impact on the parameters in the former model used from 2007 to the end of 2012, resulting in a need for amendments in the model. From 2013, a new model was implemented as a solution to the new situation, and is expected to be more sustainable than the previous. Both models are based on the weighted average cost of capital (WACC) concept. However, in the new model the tradition of using the interest rate on government bonds as a reference for a risk free investment in both cost of equity and cost of debt has come to an end. Instead, a fixed real risk free rate of 2.5 percent adjusted for inflation and a risk premium amounts to the cost of equity. Observed swap-rates and credit spreads are used to estimate the cost of debt.

JEL Classification No.:
Keywords: cost of capital, cost of equity, cost of debt, investment, electricity network regulation

1. Introduction

The economic regulation of the electricity network operators should not be an obstacle for attracting the capital needed to the sector. The regulated cost of capital is decided by a weighted average cost of capital model (WACC) consisting of a cost of equity and a cost of debt. The cost of equity is based on a capital asset pricing model (CAPM).[1] The WACC shall define the return on assets a company must earn to satisfy its creditors, owners, and other providers of capital.

The Norwegian electricity network operators are regulated using revenue caps based on yardstick competition. The WACC has at substantial impact on the determined revenue caps. The Norwegian DSO model is described in Amundsveen and Kvile (2015).

When the financial crisis [2] began to affect Norway in August 2007, the financial markets changed. The changes were moderate until September 2008 when the debt rates increased dramatically. The underlying assumptions in the WACC model were affected, and the WACC did no longer reflect the required cost of capital for the network operators.

2. The regulatory cost of capital

WACC models are widely used in regulation of infrastructure and can probably be viewed as an industry standard. [3]

The model comprises of an estimated cost of equity and an estimated cost of debt. The cost of equity shall reflect the opportunity cost for an investor and the cost of debt shall reflect the lenders required rate of return. These costs are weighted together to reflect the total cost of capital, and the weights should, from a regulatory point of view, reflect the optimal gearing for an efficient network operator.

In our regulatory model, the exact level of each parameter in the WACC is not crucial; the network operator should expect a reasonable return on his investments from the resulting cost of capital.

From a regulatory point of view, it is important to stress that a company's inefficiency in the capital market concerning size, structure, competence etc., should not be reflected in the WACC.

NVE started using a WACC-model to regulate the rate of return in 2007. The model was established based on recommendations from the consultants Dreber, Lundkvist & Partners (DLP) [4] in cooperation with Pricewaterhouse-Coopers (PWC). During 2005 and 2006, NVE undertook two public consultations [5] concerning the proposed models, before the final model was implemented from 2007:

$$WACC_{post-tax} = (1-G) \times [(R_f(1-t) + \beta_e \times MP] + G \times (R_f + P_d) \times (1-t) \quad (1)$$

Where,

G = Gearing (Debt share of total capital): 0.6

R_f = Nominal risk free rate: Annual average return on 5-year government bond

β_e = Equity beta: 0.875, estimated from an asset beta of 0.35

MP = Market premium: 4 %

P_d = Debt premium: 0.75 %

t = Tax rate: 28 %

The WACC model is formulated as a post-tax formula, but in the economic regulation, a pre-tax WACC is applied. The model above was recalculated and simplified to a pre-tax formula, and expressed in the regulations as:

$$WACC_{pre-tax} = 1.14 \times R_f + 2.39\% \quad (2)$$

3. The financial crisis

NVE received complaints on the WACC model already in 2008. Several of the network operators expressed concern for their financial situation, considering the regulatory cost of capital. They worried that they would not be able to attract sufficient capital to carry out necessary investments. Especially was their concern the decreasing return on government bonds and the increasing debt premium in the market.

The risk free rate of return was based on government bonds, which is common among European regulators of network operators. For a rate to be risk free, it requires the removal, or minimization, of repayment risk. Due to the ability of governments to raise finance through taxation, government bonds are normally used as estimates of a risk free rate of return. However, in practice no investment is totally risk free. The financial crisis led to changed "behavior" of Norwegian government bonds, as well as in many other countries. In Norway, the changes led to historically low rates of return on government bonds mainly due to a significant increase in foreign demand. In some other countries, the crisis had the opposite impact, since the government bonds were considered more risky than before. To compare; the Norwegian 10-years government bond was as low as 1.5 percent [6] during 2012, while in Spain it hit 7 percent. [7] The cause of the low rate in Norway is a high demand, combined with a relatively low supply. The Norwegian state has net receivables, and they mainly issue bonds to have a certain amount of liquidity, to regulate the liquidity in the bank sector, and to maintain and develop efficient financial markets. [8]

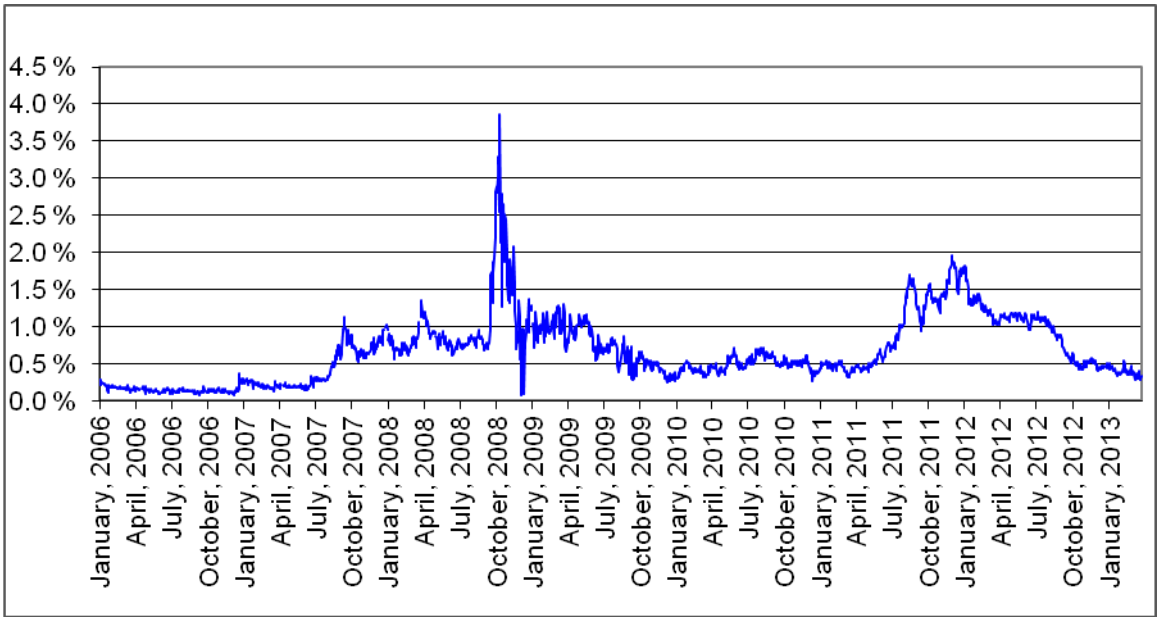

Figure 1 – Credit risk – Deviation between 6 months NIBOR and 6 months Treasury bill

In addition to the challenges tied to government bonds, a huge increase and volatility in credit risk was observed in the markets. Figure 1 shows the general debt risk in the market measured by the spread between 6 months Norwegian Interbank Offered Rate (NIBOR) and the Norwegian Treasury bill (statskasseveksel). In the WACC model from 2007, this spread was fixed to 0.25 percent based on historical figures. The financial crisis made the spread highly volatile, and might have caused a permanent shift in the credit premiums.

The economic regulation of network companies has a long-term view: it shall ensure a reasonable rate of return on a long-term basis, not necessarily on an annual basis. The network sector had earned substantially more than what was regarded as a reasonable rate of return on assets in the period 2000-2006. NVE was of the opinion that it was not appropriate to amend the regulations during an ongoing crisis, since the outcome of it was very uncertain. If the crisis took such a turn that severe problems occurred, NVE would consider opening up for dispensations from the regulations. That would imply that the network operators for a period could apply for a higher regulated cost of capital than the existing regulations prescribed.

NVE saw that the crisis could have some extensive negative implications for the highly needed investments in electricity network assets. The companies pointed out that especially the conditions in the credit market had tightened. From 2009, NVE collected information about the companies' actual costs of debt, to compare them with the cost of debt element from the WACC. NVE observed an increasing deviation from 2009 to 2011, in disfavour of the companies. Table 1 shows that regulated and actual costs were approximately the same in 2009, but the actual costs were higher than the regulated in 2010 and 2011, at an increasing rate.

Year	Cost of debt in WACC	Actual cost of debt [9]
2009	4,08	4,04
2010	3,58	3,80
2011	3,31	4,06

Table 1 - Comparison of regulated and actual cost of debt

After some time, due to the observed changes in the markets in the period 2007-2011, NVE decided to assess the existing WACC model. NVE established a reference group consisting of representatives from the electricity network owners and their branch associations to get inputs and feedback during the assessment. Financial institutions were invited to present their views

during the work. The largest energy branch association in Norway, Energi Norge, commissioned PWC to evaluate the present WACC model. [10] NVE commissioned Professor Thore Johnsen to assess their own work, and to give his views and recommendations to the new proposed WACC model [11] before the public consultation.

NVE submitted the proposed new WACC model for public consultation in June 2012. [12] After the review of the stakeholders inputs to the proposals, NVE decided on the new WACC model in December 2012. [13] The model entered into force from January 2013.

4. The new WACC from 2013

The aim of the new WACC model is to continue with a stable and predictable regulated cost of capital, but at the same time to a larger extent take into account the changes and fluctuations in the financial markets. The lesson learned from the last few years was that the markets had not stabilized, and there is no clear indications that the current observed levels of parameters would last. The current and future needs for expanding, upgrading and renewing the electricity networks were also backdrop during the assessment. The changes concerned the risk free rate, the market premium and the debt premium. The new WACC model is:

$$WACC_{pre-tax} = (1 - G) \times \left[\frac{R_f + Infl + \beta_e \times MP}{1-t}\right] + G \times (Swap + P_d) \quad (3)$$

Where,

G = Gearing (Debt share of total capital): 0.6 *(same)*

R_f = Real risk free rate for equity: 2.5 % *(changed)*

$Infl$ = Moving average of 4 years inflation, observations from previous year and the current year, and expected inflation for the next two years *(changed)*

β_e = Equity beta: 0.875, estimated from an asset beta of 0.35 *(same)*

MP = Market premium: 5 % *(changed)*

Swap = Nominal rate for debt: Annual average of 5-years swap rate *(changed)*

P_d = Debt premium: Annual average of credit spread for 5-year bonds for the power sector, minimum rating BBB+ *(changed)*

t = Tax rate: 28 % *(same)*

The challenges tied to Norwegian government bonds required an alternative approach for the estimate of a risk free investment. Considering that government bonds are the standard approach, NVE had to come up with alternatives. During the WACC review in 2004-2006, one of the main discussions was the two alternatives: A floating nominal rate based on government bonds, or a fixed nominal rate based on assumptions of the average future growth in the Norwegian economy. [14] There are pros and cons to both fixed and floating rates of return. A fixed rate of return will give stability and predictability for both network operators and consumers, while a floating rate of return will reflect the current state of the market.

Challenges with a fixed rate arise when the chosen rate deviates from the market rate. Consumers would probably oppose to pay tariffs that reflect a higher rate than the market rate. The network operators might experience funding problems if the market rate is higher than the fixed regulatory rate. If the fixed rate is too low, it could lead to lower investments than desired. If the rate is too high, it could lead to more investments than desired. There has also been a discussion whether short-term or long-term rates are best. Short-term rates reflect the current market rates, but NVE has put significant weight to the aspect that investors in the sector should have a long horizon on their investment decisions.

The biggest challenge with the regulatory cost of capital during the financial crisis was that it did

not reflect the market situation. NVE decided to propose two separate risk free rate of return for the estimation of cost of equity and cost of debt. The former is a fixed long-term real rate of return, adjusted for inflation. The latter is tied to the development of the financial markets. The reason for using two different risk free rates is that the electricity network operators have different approaches to the cost of equity and the cost of debt. Investments in electricity network assets have a long time horizon, where cycles in the market over a few years do not have significantly impact on investment decisions. The cost of debt affects the companies' cash flow, and large deviations between their actual and regulated cost of debt would probably influence both their investment decisions and their sustainability.

A "neutral" rate of return is a medium to long-term rate that reflects the real growth in the national product. From 1900 to 1969, the real growth in Norway was on average 2 percent. From 1970 to 2005, it increased to 3.1 percent. The Central Bank of Norway estimated in 2006 a "neutral" rate in the interval of 2.5-3.5 percent, but in 2010, they adjusted it downwards to 2-3 percent. The ministry of Finance published in October 2012 an updated version of the NOU (Official Norwegian Report) on "Socioeconomic analyses"[15], where they suggested an average risk free real rate of return of 2.5 percent for investments with a lifetime up to 40 years. NVE decided to use a fixed risk free real rate of return of 2.5 percent for the cost of equity in the new WACC. The real risk free rate is converted to a nominal rate by adding inflation estimated as an average of 4 years. The average is based on observed inflation for the previous and current year, and the expected inflation for the coming two years.

The market premium was increased from 4 to 5 percent in the new model. PWC increased their marked premium for Norway from 4.5 to 5 percent in 2008. In 2011, they carried out a survey [16] of the Norwegian market premium for 2010 and 2011, and estimated a premium of 5 percent on average. Thore Johnsen (2012) suggested using an international marked premium of 4.5 percent together with a beta value of 0.4. The products of the betas and market premiums proposed by NVE and Thore Johnsen were approximately the same, and NVE decided to use the present beta value of 0.35, together with a Norwegian market premium of 5 percent.

To estimate a risk free rate of return for cost of debt, NVE introduced a swap-rate in the model. A swap-rate is an agreement between banks where they swap fixed and floating rates. When a bank swap a financial agreement of 5-years loan with fixed rate of return for an agreement with a floating rate of return, it gives a good indication on what the price for a 5-years loan will be. A bank will probably not lend money to customers to a lower rate of return than the swap-rate for loans with similar maturity. In financially stable periods, swap-rates will follow the same path as government bonds. In unstable times, it will follow the development in the financial market, and to a larger degree reflect the companies' actual risk exposure and cost of debt.

Swap-rates include a general credit risk. This risk premium was in the former WACC model estimated by the spread between government bonds (risk free rate) and NIBOR. In the new WACC model, there is no need to include a separate premium for this risk, since it is embedded in the swap-rate. However, the sector specific credit risk must be added.

The credit risk was highly volatile during the financial crisis. There is also a good chance that it will "stabilize" on a higher level than before 2007. Instead of using a fixed debt premium, NVE has based the premium on 5-year bonds issued by the power sector. The two biggest banks in Norway calculate the annual average credit spread for 5-year bonds for the power sector with a rating of minimum BBB+.

5. Concluding remarks

NVE submitted the proposed new WACC model for public consultations. Most of the feedbacks from the electricity network operators were positive; they thought the new WACC model reflected the actual cost of capital more correctly than the previous model.

There were some feedbacks regarding the calculation of equity, and especially the proposed fixed risk free rate. The industry, especially the energy intensive industries, argued that the new model would give a too high rate of return considering that the network sector is a regulated monopoly with low exposure to risk. They worried about the use of a fixed rate of return, especially since 2.5 percent currently was high compare to the actual rate of return on government bonds.

The new NOU on "Socioeconomic analyses" points out theoretical weaknesses using the Capital Asset Pricing Model (CAPM) to estimate the cost of equity. They highlight the weakness with both identifying the systematic risk at the stock market and predicting a relevant risk premium for investments in the public sector. In light of this, the Ministry of Finance viewed that the cost of equity used in the WACC model might be too high for network operators. In December 2012 they stated in a letter to the Ministry of Petroleum and Energy [17] that they did not oppose to setting the new WACC model into force from 2013, but in their opinion it would be advisable to evaluate the method in the future.

Based on thorough reviews of all inputs from the stakeholders, NVE decided to approve the WACC model as proposed in the public consultation. The fixed risk free rate of return of 2.5 percent is currently high, but with a long-term view on the regulation, NVE thinks this will even out.

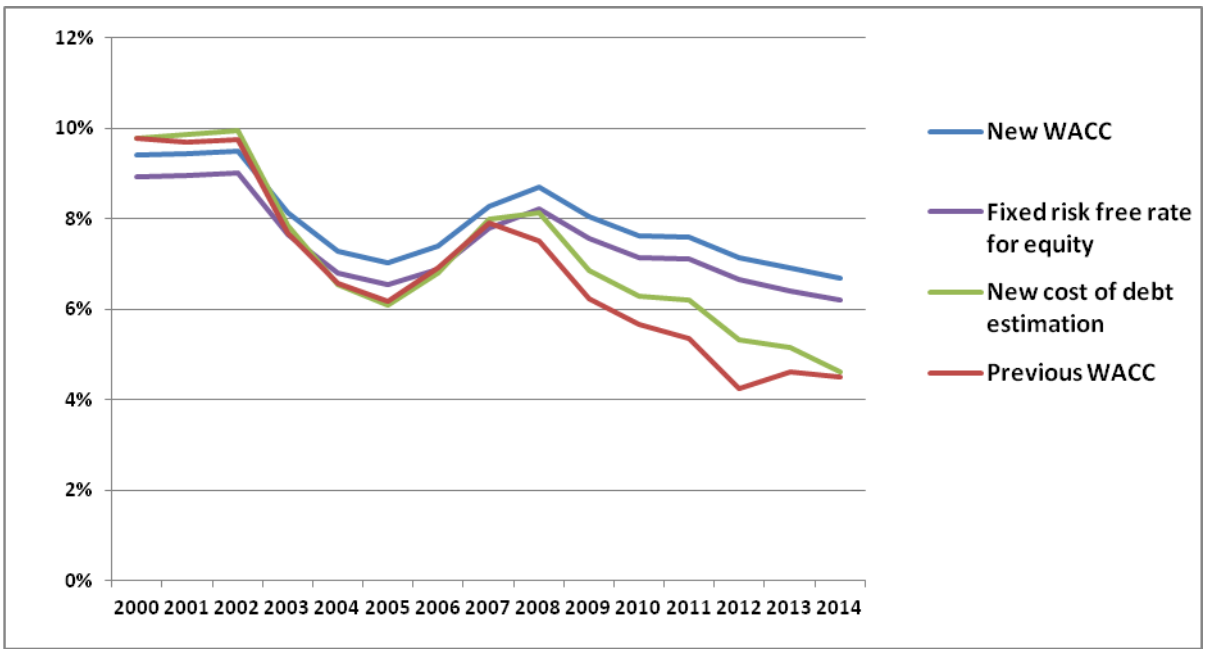

Figure 2 – Effects of changing from the old to the new WACC model

Figure 2 shows the consequences of the changes from the old to the new WACC model in steps, using the new parameters historically. The red line shows the regulatory cost of capital using the previous WACC model historically. The green line shows the previous WACC model with the new cost of debt formula. It shows that the old and the new model for estimating cost of debt gives the same result prior to 2007. After 2007, the new parameters give a higher WACC, until 2014, when they are nearly the same again. The financial markets have calmed down and the government bonds have increased. The purple curve shows the effect of adding the fixed risk free real rate of return adjusted for inflation to the previous model. Using the fixed risk free rate instead of a floating government bond gives a lower cost of equity in early years, since the return on government bonds were higher at that time. In later years, the new WACC is significantly higher due to the low rates on government bonds and a high fixed rate. The blue curve shows the new WACC model, where also the market premium is changed. A permanent shift in the market premium from 4 to 5 percent shifts the whole curve upwards.

NVE is of the opinion that the new WACC model will be more sustainable than the previous model. The electricity network operators can expect a reasonable return on their investments over

time, and hence be both willing to, and able to, carrying out the huge investments that are expected the next few years.

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[3] CEER (2011).

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[8] https://www.regjeringen.no/no/tema/okonomi-og-budsjett/norsk_okonomi/statsgjelden/id443404/

[9] Average cost of debt for non-integrated electricity network operators, i.e. utilities without other activities than network operations.

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[11] Johnsen (2012).

[12] NVE (2012a).

[13] NVE (2012b).

[14] In principle, a better approach would probably be to have a fixed rate of return tied to each investment undertaken in one particular year, which would follow the investment through its whole lifetime. Since this is more or less impossible to accomplish in practical regulation, this option was not discussed further.

[15] Finansdepartementet (2012).

[16] PWC (2011b).

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VIII. Energy Access as a key factor for human development: The View of Mediterranean Regulators

By Veronica Lenzi and Nicolo di Geatano

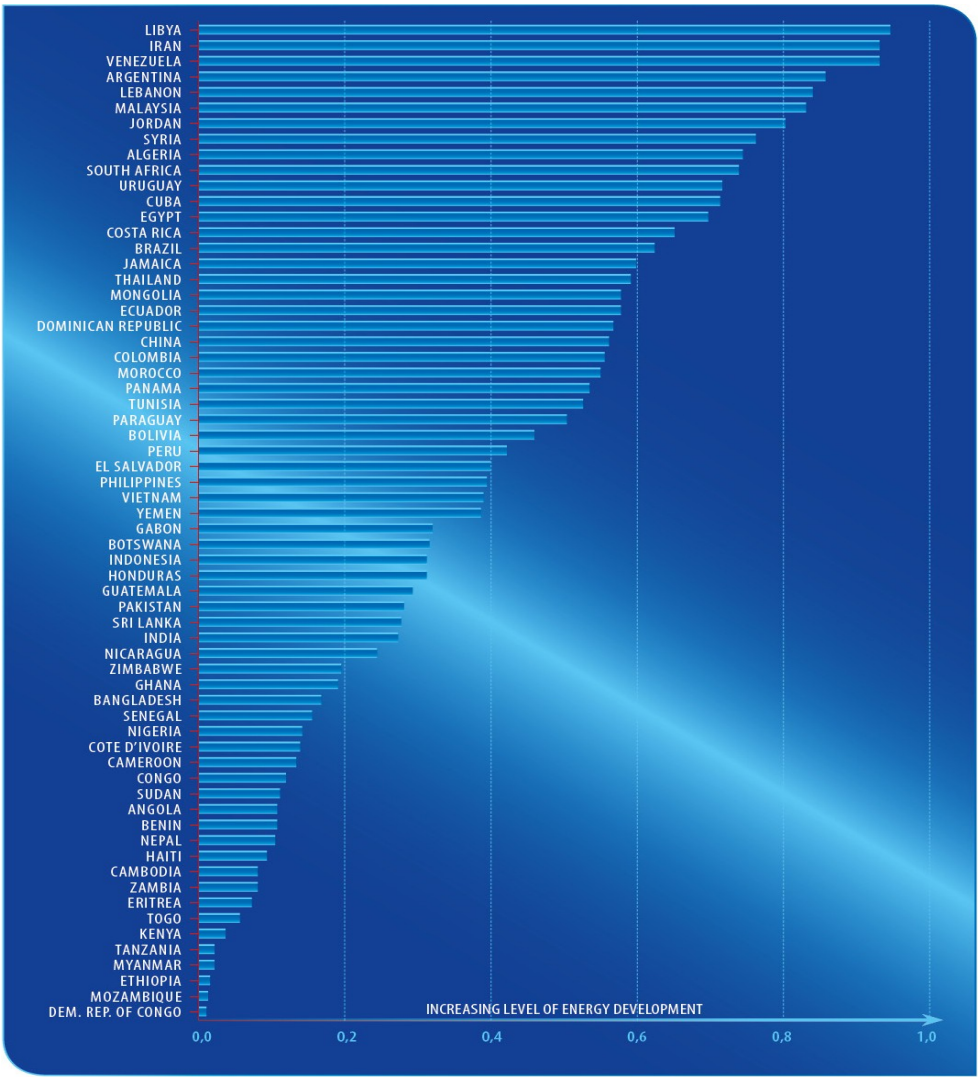
1. Introduction

Access to energy is an objective far from being reached in developing countries, even in those showing growing incomes. The Middle East and North Africa (MENA) region has traditionally been overlooked when it comes to energy poverty because of its richness in natural resources. However, energy poverty also affects countries that have abundant resources. Frequent black-outs are still present in suburban rural areas and severely impact quality of life, most notably concerning labor availability, education access, health facilities and the environment. Indeed, several studies underlined how energy poverty is mostly linked to inadequate policy and regulatory measures rather than to the lack of energy resources, as well as due to economic crisis that do not allow to benefit of energy for a better life.

According to the World Bank, expanding access to energy can contribute to alleviate the time-consuming activity of fetching wood, it supports an healthier and safer environment and it creates time and opportunity for poor people to generate more income. However, these envisaged social and environmental progresses are possible if proper infrastructures are in place. But investors finance proper infrastructures only when the energy sector is administered through a clear, stable and transparent set of regulations.

Energy regulation is then a key to make better energy more available to low-income households. Presently, there is a substantial gap to be filled in order to satisfy energy access needs throughout the world. According to the World Bank, the largest and poorest socio-economic group in the world (the so-called base of the pyramid, i.e., the 3 billion people living with less than 2.50 dollars per day) spend 37 billion dollars each year to obtain energy supplies. The International Energy Agency (IEA) calculates that 1.4 billion people lack energy access. Almost 85% of these people live in rural areas. However, there are several disparities within this large group.

Looking at Figure 1, which shows the Energy Development Index [1] of African countries, it is possible to notice that most Mediterranean countries rank in the upper half of the graph, testifying to the policies that these countries have enacted to guarantee access to energy to their citizens. The data on Libya are referred to the period prior to the recent political turmoil and are likely to be different now. Below, some examples of electrification policies are provided, with reference to the Euro-MENA region during the last decades.



2.1. Energy poverty and electrification in the Euro-MENA region

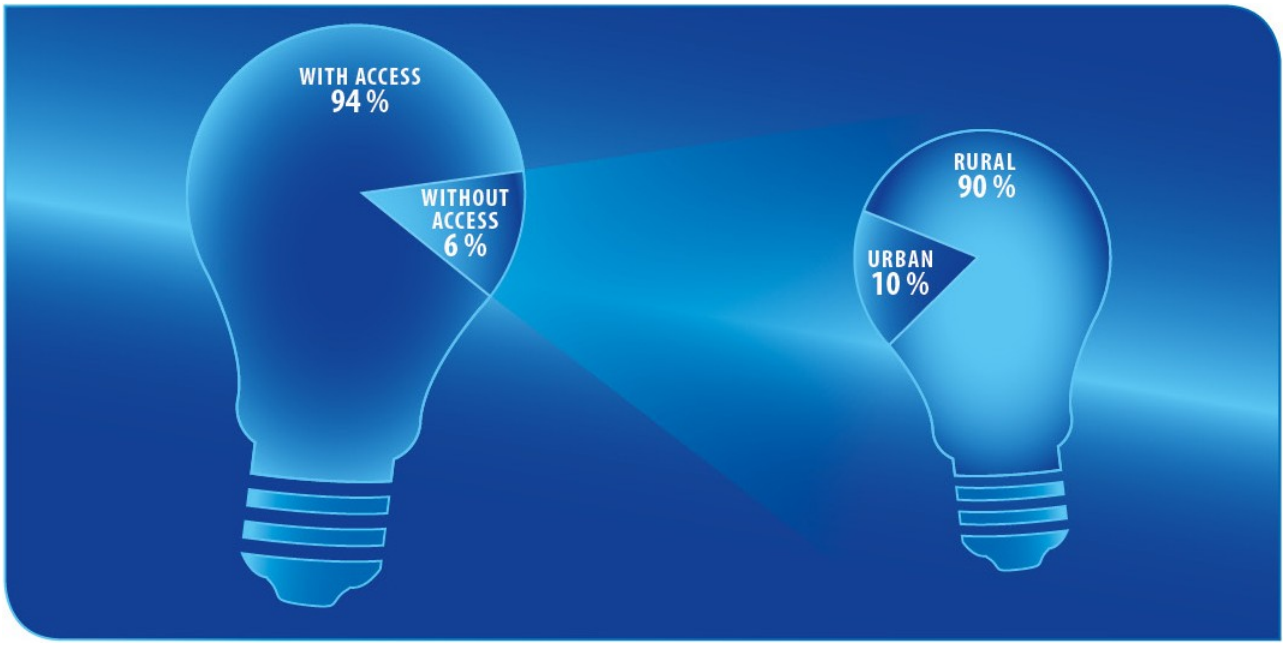
With a look to the Mediterranean countries, the electrification rate in the MENA region reached 94%, with energy intensity steadily increasing in the last 25 years. Two-thirds of consumers connected to the grid live in urban areas, where the access rate in the last twenty years increased at twice the rate of rural areas. However, as the increase in population of urban areas was modest, the electrification rate of rural areas substantially increased, despite the low investments. The country that made more progress so far is Egypt, whose electrification rate grew by 1.6% between 1990 and 2010. However, almost 6% (18 million people) of the MENA population still lacks access to electricity, which corresponds to 1.5% of people without energy access worldwide.

The MENA region benefitted from a rapid expansion of investments in energy infrastructure, which led to an almost full electrification of the region, first of urban areas (1950-1960) then of rural areas (from the mid-1990s). It should be noted that electrification rates do not provide a complete picture concerning the regional energy situation. While electrification is virtually present, in practice low income levels and scattered geography often prevents the actual access to electricity. However, according to the World Bank, due to the low incomes or to missing network coverage, 20 million people in the region cannot access electricity in a continuative and satisfactory way. These people then tend to rely on biomass fuels (waste materials and firewood) and kerosene, which are low-quality and polluting fuels. Interestingly, this habit seems to partially

continue even when the household income increases, contradicting the notion that increasing money availability leads to choosing higher quality fuels. In fact, while the population of most MENA countries are above the low-income average of 242 kWh per capita, [2] numbers are partially distorted by the industry consumption and does not fully account for the habits of the households.

Algeria

In Algeria, the public programs of rural electrification (Electrification Rurale, ER) target the most disadvantaged and geographically remote regions. ER programs are part of the policies of continuous development of the country and can either be national, regional or ad-hoc ones. They are financed by the state for 75%, while the remaining 25% come from gas and electricity distributors, upon signature of specific protocols.



The target of this programs are jointly located by the Ministry of Energy, the various provinces and the distributors. Distributors are responsible for the implementation of the projects as they have then to manage this part of the grid. In the decade 2000-2010, around 34.000 new kilometers of grid were realized, connecting roughly 312.000 households.

Morocco

Comprehensive programs to electrify the rural areas of Morocco date back to 1963 when the National Office for Electricity (ONE) dedicated economic resources to the extension of transmission and distribution networks, both in the cities and in rural areas. This expansion of the network continued until 1981.

In 1978, the government implemented a specific program called National Program for Rural Electrification (PNER). At the beginning of the program roughly 130.000 households were supplied in rural areas. In the first phase of PNER (1982-1986), 68.000 additional households were electrified. This phase was evenly financed by the state and by local authorities and benefitted from a loan of 30 million dollars coming from the International Bank for Reconstruction and Development (IBRD). The second phase of PNER started in 1991 and led to the further electrification of 155.000 households. It was totally financed by local authorities and supported by

a 114 million dollars loan from IBRD and a 30 million dollars loan from the European Investment Bank (EIB).

Morocco, in cooperation with France, also developed a program of rural pre-electrification (PPER) to support electrification off the grid, which started in 1995. The project envisioned the equipment of 240 villages with various decentralized solutions, such as individual or collective solar systems and mini-grids.

Jordan

In Jordan, the percentage of electrification reaches around 99.9% of all rural and urban areas. This positive result comes from the work of a special unit in the Ministry of Energy and Mineral Resources to deal with electrification of rural areas. This unit is funded through the national electricity tariff. Pursuant to the tariff provisions issued by the regulator, each distribution licensee collects 1 Jordanian dinar per each Kwh sold to the end consumers on a monthly basis. Distributors then transfer the collected amounts to this special unit.

The unit receives all applications to connect the rural areas to the grid coming from customers living there, particularly applications from remote villages. The unit evaluates each application, sets the priorities and takes the necessary decisions to fund and cover the costs of electrification. Distribution licensees execute rural electrification projects as subcontractors.

As a recent MEDREG study on infrastructure investments confirms, a cross-border approach is also important to raise the chance of increasing energy access numbers. Many interconnection projects are large in size and cover different countries, thus providing for interesting economies of scale, increasing security of supply and potentially lowering electricity prices. For example, a network interconnection already exists in North Africa and another one is being developed in Southern Africa (Southern African Power Pool), even if with scarce energy exchanges. It is beneficial to have highly coordinated national energy regulators throughout regions that are concerned by common infrastructure projects.

In this sense, significant progress took place in the Mediterranean basin during 2014. Egypt started a substantial reform of its energy sector, including the establishment of a regulatory authority for the gas market. Morocco has been moving forward in the process for the setting-up of a regulatory authority for electricity and gas. The draft law reforming the energy sector has been presented to the national stakeholders and will be submitted to the Parliament as soon as an agreement is found between the government, the local administrations, the public operator and the main trade unions. In addition, the mission of the electricity regulator of Jordan was extended to all mineral resources and the agency became the Electricity and Mineral resources Regulatory Commission (EMRC).

Cross-border coordination among institutions in charge of regulation is particularly relevant. Regulators should specifically discuss and agree on how to develop projects that can benefit the parts of the population that are still lacking access to energy. This coordination also serves the scope of energy efficiency and environmental preservation, as it should target projects that are sustainable for and beneficial to all the areas they cross. Also, local projects that are successful in one country could be replicated through exchange of experiences among regulators. For example, smart projects that are implemented in some countries with the scope to balance demand and support in the agricultural sector, such as micro hydraulic projects for irrigation fed by renewable energy sources (RES) that are currently taking place in Morocco, could be replicated in other areas of the continent.

In order to reinforce transmission and distribution grids at national level it is important to take into account specific national aspects of Mediterranean countries, such as long term and transparent tariffs, security of supply, technical safety, quality of service, better allocation of costs and return on investment made by operators, and fair treatment of market actors and energy consumers, with particular consideration for energy poverty issues.

It should also be noted that, although the existences of several Southern Mediterranean interconnections, electricity trade among these countries has remained modest. The average level of use is not more than one third of the total capacity, not only because of the lack of development of national markets, which are mainly vertically integrated monopolies. Bad coordination between regulators and TSOs, barriers both at the national and regional level such as limited generation reserve margins, the absence of an harmonized regulatory framework and institutional weakness are all causes of the issue. Therefore, while considering new infrastructure investments, MEDREG Southern regulators should consider a better use of existing ones.

Additionally, MENA countries have been making efforts on increasing their rural electrification rates, also using RES. Due to long distances and harsh conditions, the expansion of the high voltage networks for serving few dispersed customers may result to be an expensive task. Experience from MENA countries has shown that the use of distributed generation based on solar energy, mainly PVs, can help significantly improving the electrification rate with concrete social benefits to the local population at competitive costs.

For instance, in Morocco, in the period 1995–2008 the electrification rate in rural areas has increased from 18% to 98%. 10% of the increase has been solely based on PV kits.

Looking at RES investments in the MENA region, in 2010 Morocco launched a national framework that established to reach 20% of RES-generated electricity in the following ten years. Morocco targeted solar energy in particular, and established to reach 2000 MW by 2020.

Figure 3 - Electricity produced from RES in the MEDREG countries. Source: MEDREG (2013).

3.

How independent energy regulators can fight fuel poverty

A problematic issue of energy supply in the MENA region, particularly in rural areas, is the high level of unreliability of the grid. Several reasons can cause this problem. Network suppliers may lack enough available capacity to serve all consumers and thus have to ration supplies, mostly to rural areas. Endemic underinvestment in the maintenance and improvement of the lines also cause technical problems and outages, which add to the frequent illegal connection of households to the network, which often causes overloads. Even in areas where mini-grids projects are active, the capacity of generation facilities only allow a few hours of service per day, depending on fuel availability. All this results into an highly volatile electricity supply. This unreliability not only represents a breach to quality of supply for the connected consumers, but also discourage non-connected consumers from establishing an electricity interconnection when possible, opting instead for the more expensive option of self-generation in order to accomplish the activities which require electricity. In the MENA region, underinvestment in electricity infrastructure tends to become a constant aspect of the sector, leading to shortfalls in the overall economic development of the countries.

For all the above mentioned reasons, the role of the regulator is particularly important. In fact, guaranteeing energy security and sustainable development requires the consolidation of electricity and gas infrastructures. An independent regulator with clear powers and competences enables an efficient market design and promotes networks management with a consistent level of transparency and access to information. This, in turn, enhances favorable conditions for energy

infrastructure investments with the aim to guarantee an higher quality of supply and sustainable prices.

There are four key issues that public institutions need to address in order to create adequate policy frameworks for connecting to the grid.

- Incentivize utilities to expand their network infrastructure to areas that are mostly non-connected, also providing support in fighting energy theft and illegal connections.
- Support disadvantaged citizens in the bureaucratic process to connect to the grid.
- Provide specific incentives for utilities to serve unconnected people.
- Support poor people financially in order to facilitate their access to energy.

The role regulators can play to fight energy poverty is essential. Any regulation aiming at increasing access to energy should be based on several aspects pertaining to efficient regulatory governance, mostly concerned with the way regulation should be implemented in order to deliver its objectives.

3.1. The competences of regulators

MEDREG, which has studied regulatory competences and principles that should be applied by Mediterranean energy regulators, considers that some of these principles are particularly relevant to the issue of energy access.

Figure 4 - MEDREG Principles for Effective Regulation

In order to provide an effective environment for consumers and potential consumers as well as for companies and investors, the competences of regulators should include the following:

- Possibility for all interested citizens to connect, facilitating the access to off-the-grid solutions for electricity supply when on-the-grid alternatives are not available.
- Definition of standards for electricity quality, including continuity and quality of supply.

- Setting levels and structures of tariffs for use of infrastructures, periodically assessing and revising them in order to promote an efficient management and support necessary developments.
- Provisions of subsidies, both indirect (actions that may affect regulatory decisions) and direct (resulting from a regulatory decision), evaluating how they are likely to affect patterns of supply and demand.
- Data collecting from the regulated companies , to monitor energy markets and systems state of the benefit of all energy market stakeholders.
- Clear and no-discriminatory licensing and permitting, including the management of dispute settlement about licenses, the information that should be provided to obtain a license and the obligations that a license entails.
- Promoting competition and efficient market structure, focusing on the unbundling of the various sectors of the market, establishing competitive retail and wholesale markets, and protecting customers.
- Promoting energy efficiency and the use of renewable energy sources, as well as supporting poor electricity users.

The reason for creating strong and independent regulators is that they should increase efficiency and effectiveness in the energy sector. However, even when regulators are autonomous in theory, in practice they may be captured by the political power or unable to be transparent and accessible to the consumers. Where these problems happened, they impacted vulnerable and poor consumers for the worse. Regulators need to be independent in order to be less exposed to political pressures and to properly act in the public interest.

This calls for careful consideration when designing or reforming the role and functions of an independent energy regulator. The mandate to protect poor consumers can be referred to the broader mandate to protect consumer interests. However, as poor consumers are for the most part unable to make their voice heard, an explicit pro-poor mandate should be given to those regulators that operate in countries where lack of energy access plagues a considerable amount of citizens. In these cases, the United Nations suggest considering the creation of a low-income advisory body that performs specific pro-poor programs and that ensures that poor consumers are represented along with the other consumer categories.

Independent energy regulators serve to deliver consumers and utilities a service in an accountable and transparent way. Regulators operating in the same region share common goals and challenges. They include ensuring proper market conditions (including access) to all the actors, guaranteeing good quality of energy supply at an affordable price, informing and protecting consumers and citizens, and promoting an efficient and affordable integration of renewable energy sources.

Besides energy connections, with a view also to more developed countries affected by the economic crisis, the challenge is to support vulnerable energy consumers and poor citizens, fighting fuel poverty through the usage of social tariffs.

In Italy, the government has introduced a protection mechanism targeted to domestic customers living in condition of economic hardship or with severe health problems. This mechanism has been active since 2009 for electricity supplies and since 2010 for supplies of natural gas.

Eligible customers receive a discount of about 20% of the electricity bill and 15% of the gas bill, depending on the number of people living in the same household. An additional bonus is set for those customers who use electricity for domestic medical appliances in order to compensate for the costs for their consumptions.

At the end of 2014 the bonus was applied to about 1 million households. The number of households receiving an electricity discount as a result of physical hardship was about 24.000. At the same date about 600.000 gas customers benefitted from the gas bonus for economic hardship.

The social bonus is funded by a small levy applied to all consumers bills. The mechanism has been declared fully compatible with competition in electricity and gas retail markets as vulnerable customers are free to choose their suppliers on the energy market.

4. Conclusions

Mediterranean national energy markets are today at very different degrees of maturity. In the Southern shore utilities are state-owned and operate either based on vertically integrated service providers or using a single buyer model. Most of these utilities are running at high degree of subsidies, which do not provide a right price signal for private investors. Therefore, most of the investments are financed by the state. However, States face increasing difficulties in keeping the current level of subsidies. Reform of the electricity and gas sectors are being discussed in various Southern countries. Egypt, for example, is currently designing a substantial reform of its electricity sector. The presence of independent regulators is pivotal to guarantee that the reform balances between the needs of investors and consumers, and to subsequently provide investors with a clear framework of rules.

Indeed, regulators should dedicate increasing attention to enhance the level of efficiency interoperability and the quality of planning of energy infrastructures. Cross-border infrastructures are crucial to overcome the actual fragmentation of the Mediterranean energy system. The creation of adequate, integrated and reliable energy networks is a prerequisite to deliver a properly functioning energy market that will enhance security of supply, integration of renewable energy sources, energy efficiency and will enable consumers to benefit from new technologies and a smart use of energy.

Energy poverty shall be fought by making infrastructure more efficient and reliable, as well as supporting fist-time connections and vulnerable consumers through a set of options that can be acceptable to local stakeholders and that are economically sustainable. Inefficient energy subsidies represent the main economic distortion hindering the development of pro-poor investments, both in the energy sector and in other relevant sectors such as health and education, thus raising doubts about their effectiveness in fighting poverty in the region. On the contrary, when money is invested in electrification programs, as it has been done in Morocco and Jordan, the investment can reach out to a substantial number of unconnected consumers without a negative social impact in other sectors.

The establishment of an appropriate and effective Mediterranean energy framework is therefore a key factor to build an environment that fosters sustainable development. Regulation can support a more efficient infrastructure system with monitored energy flows both for electricity and gas, as well as promote new investments for infrastructures of regional interest to create the condition for an competitive regional energy market. For countries where a working legal framework already

exists, it is important to maintain and improve it in order to balance industrial initiatives and consumer protection for the benefit of all parties.

This report was prepared by the MEDREG Working Group on Consumer Issues (CUS WG) in the period April - May 2015.

Examples and comments were provided by the members of the CUS WG.

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[1] According to IEA, the Energy Development Index is “a multi-dimensional indicator that tracks energy development country-by-country, distinguishing between developments at the household level and at the community level. In the former, it focuses on two key dimensions: access to electricity and access to clean cooking facilities”.

[2] Elaboration made in 2014 by Ms. Laura El-Katiri on 2010 combined data from the World Bank for the overall MENA region. The average electric consumption for middle-income average for the same year is 1823 kWh per capita, while for the high-income average is 9414 kWh per capita. The World Bank measures electric power consumption as the production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants.

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IX. The Role of Improved Communication & Technology in Enhancing Damage Prevention Practices: Why use 20th Century Technology to combat 21st Century Safety Challenges?

By Brigham McCown and Shane Skelton

Striking a utility line in small or even large excavation projects can have disastrous results if proper procedures are not followed prior to digging. Thousands of pipelines and other facilities run underneath homes and businesses, providing essential services, facilitating all aspects of life from water and electricity to cable television and gas.

There are more than three hundred thousand miles of gas transmission lines and two million miles of gas distribution lines in the United States. While any damage to any underground facility can have serious repercussions, this is especially true of gas lines, since they transport explosive natural gas, are highly pressurized in certain areas, and can be found subsurface almost anywhere.

While damage to some other facilities, such as water, sewer, and telecommunications lines, may not be as risky to human life and safety, the economic consequences are still severe. The primary problem is a simple lack of sufficient communication practices, and the industry's slow response to innovative safety technologies that could enhance information sharing.

For example, despite significant improvements in GPS and other digital mapping technologies in recent years, incident rates have not improved. According to the federal government's Pipeline and Hazardous Materials Safety Administration (PHMSA):

- There were **560 gas line incidents caused by excavation damage** over the past ten years (from 2005-2014) [1]
- These incidents accounted for: [2]
    - **35 fatalities**
    - **127 injuries**
    - **$125 million in property damage**
    -

Improvements are needed. Increased use of the best available locating and mapping technologies, improved communication between all parties (including utilities, excavators, locators), and stronger regulatory enforcement will go a long way in reducing the frequency and severity of incidents.

What has been done in the past?

PHMSA, a part of the U.S. Department of Transportation is responsible for overseeing state and federal damage prevention safety programs. PHMSA has been consistent in taking a non-regulatory approach to pipeline damage prevention, but does engage in multiple efforts to improve the safety of excavation practices and provides states with guidance in strengthening their laws and regulations. [3]

For example, PHMSA tracks and publishes pipeline excavation damage data online for the public to access easily. The administration also performs studies as directed by Congress to identify

potential areas of improvement, and issues Advisory Bulletins to "emphasize important actions pipeline operators can take to protect their pipelines." [4] In addition, PHMSA provides grants and technical assistance to states and communities, and performs research and development projects with the purpose of enhancing safety efforts.

The 811 Program: Call Before You Dig

Each individual state is responsible for its own damage prevention program and there are also nationwide efforts to support these programs. The 811 Dial Before You Dig program is the most prominent.

In an effort to simplify the requirement that all excavators contact their state's respective One-Call center prior to beginning excavation, the Pipeline Safety Improvement Act of 2002 directed the U.S. Department of Transportation (USDOT) and the Federal Communication's Commission to create "a 3-digit nationwide toll-free telephone number system to be used by State one-call notification systems." [5]

In 2005, the FCC announced that they would clear the number 811 from any previous obligations, and designate the number solely for One-Call centers to facilitate implementation of the program. The FCC completed their effort in 2007, and since then 811 "serves as an easy-to-remember phone number for the professional excavators and homeowners who call it, and for the damage prevention stakeholders who promote it." [6]

The excavator dials 811 prior to breaking ground to notify the relevant One-Call center where and when they plan to dig. This requirement applies to anyone planning to break ground, whether a homeowner or a commercial excavator. After the call, each individual state's laws and regulations govern next steps. States vary on the specifics, but most states require notice between 48-72 hours in advance of breaking ground.

Despite some variance from state to state, it is a relatively standard step-by-step process:

1. Excavator dials 811, or otherwise contacts the relevant One-Call center at least forty-eight hours prior to the date they plan to begin work
2. One-Call center notifies all operators of underground facilities in the work area of the upcoming excavation
3. Operator is responsible for marking, within two feet, the location of all underground facilities (or contracting with a third-party to do so) with stakes, flags, or paint
4. Excavator can begin work after one of the following conditions are met
    a. Forty-eight hours have passed
    b. Excavator receives confirmation that all facilities in the work area have been marked
    c. Excavator is notified by the One Call Center that no facilities exist in the work area

<u>This is the extent to which the parties communicate prior to commencing excavation.</u>

PHMSA's "Nine Elements of Effective Damage Prevention Programs"

Federal laws passed nearly a decade ago placed a large focus on enhancing state Damage Prevention programs.[7] Congress increased scrutiny on these programs by defining nine specific

elements that any adequate program must include, and granted PHMSA authority to pursue civil actions and levy monetary penalties against states that didn't meet these standards. [8]

The elements articulate the necessary characteristics of a comprehensive Damage Prevention plan, and were formulated by collecting input from multiple stakeholder groups through a PHMSA sponsored research project. [9] They also incorporate and align with the Common Ground Alliance (CGA) best practices on Damage Prevention. [10]

Current regulations require states seeking U.S Department Of Transportation (USDOT) grants for Damage Prevention programs to show proof that these elements are woven into its structure. However, PHMSA has not yet undertaken significant initiatives or actions aimed at encouraging grant recipients to utilize better technologies, or withheld funds from those who do not.

These elements, listed and summarized below, are not "prescriptive; rather, they are process and goal-oriented, providing latitude in how each element might be achieved." [11]

The elements are as follows:

1. *Enhanced communication between operators and excavators*

This element lays out the critical nature of clear communication between facility operators and excavators in Damage Prevention. The One-Call Center and 811 are an integral part of this element, making sure that the operators are aware of excavations going on in proximity to underground assets and the excavators in turn are made aware of the their location.

2. *Fostering support and partnership of all stakeholders*

This element calls for the support and collaboration of all stakeholders, including but not limited to: excavators, operators, locators, designers and government to put together an effective Damage Prevention program.

3. *Operator's use of performance measures for locators*

Operators often use either internal or externally contracted locators to mark underground facilities in excavation areas. The degree to which damage is minimized depends mostly on the accuracy of the work carried out by these locators.

4. *Partnership in employee training*

Employee training within each stakeholder group is vital for the development of efficient and effective Damage Prevention programs. It streamlines the process and creates collaboration between all interested parties.

5. *Partnership in public education*

Public education brings exposure to the issue of Damage Prevention, highlighting the dangers involved when proper procedures are not adhered to.

6. *Enforcement Agencies' role to help resolve issues*

Similar to Element 2, it is important that all Damage Prevention programs have the support of all stakeholders. Regulatory enforcement is a primary aspect of this. It is therefore crucial that the enforcement agency has well-designed and transparent procedures in place to deal with any issues that arise swiftly.

7. *Fair and consistent enforcement of the law*

Continuing from Element 6, in order to garner support of stakeholders, equality and fairness of enforcement is of fundamental importance. This not only increases participation of interested parties but also fosters a strong and effective Damage Prevention program.

8. *Use of technology to improve the locating process*

The ultimate success of a Damage Prevention program lies in the precision of locating underground assets. Providing excavators with an accurate layout of underground assets increases their ability to carry out the dig safely and successfully. It reduces danger to the lines and also makes the dig more efficient.

9. *Data analysis to continually improve program effectiveness.*

Research and development is a fundamental building block of any project. In this regard, collecting and analyzing data regarding Damage Prevention could help identify loopholes and provide a roadmap as to which areas need improvement in terms of training, enforcement, and technology. It could also help identify high risk factors that can be proactively addressed.

Is it working?

Thankfully, most excavation projects in the U.S. are completed without incident, but when accidents happen, they can result in disruption of television, internet, electric, or natural gas services to homes and businesses. Accidents can also be harmful to the environment, result in serious injuries, and in the worst cases, be deadly.

Excavation damage can occur for a number of reasons, but a lack of communication and information sharing between parties is usually the cause, or a large contributing factor. The following case studies summarizing recent incidents serve as an illustration of why it is important to implement strong Damage Prevention programs, educate the public on calling 811, and increase the use of innovative Damage Prevention technologies.

Fresno, California

In April 2015, a gas explosion caused 12 injuries and one fatality in Fresno, California. According to an investigation by Exponent Failure Analysis Associates, a gas pipeline ruptured and exploded when a county worker struck the pipeline with a front loader while attempting an excavation of the surrounding area. [12]

The operator filed a claim against Fresno County for negligence, claiming the cause to be the county's "improper excavation at or near a natural gas pipeline in violation of California Government Code…without prior contact to [the operator]." [13] The operator also claimed that no one from the county called 811 to confirm the location of facilities prior to beginning excavation with the front loader. [14]

Neither the operator nor the 811 One Call Center was notified of the planned excavation. Therefore, the operator did not have an opportunity to identify and mark any underground utilities in the area. This unfortunate incident, which caused severe damage to life and property, could have been avoided if the county had notified the 811 One Call Center and proper procedure had been followed.

The city could potentially be partially held responsible for not having in place an effective Damage Prevention program, which could have mitigated the risk of such an incident occurring through public education, training and awareness.

Kansas City, Missouri [15]

In 2013, a construction company struck a natural gas main while drilling underground to install a telecommunications cable in Kansas City, MO. Natural gas escaping from the damaged pipeline diffused through backfill material beneath the asphalt street, alleyway, and sidewalk. The migrating natural gas accumulated within an occupied restaurant and subsequently ignited, killing a restaurant employee and injuring several others.

Pursuant to applicable regulations, the excavators contacted Missouri One Call several days prior to the excavation, and the dig site was marked with paint to indicate the location of underground facilities, including natural gas, telephone, water, electricity, and sewage. A discrepancy in marking indicated only two facilities, where there were, in fact, three. This oversight led construction personnel to believe they had exposed all lines before drilling began. This miscommunication led to the striking and rupture of the unidentified natural gas pipeline that subsequently caused the explosion.

It is probable the damage to the natural gas main and subsequent explosion would not have occurred if the construction personnel were made aware of the additional line, prompting them to take further actions to expose the natural gas line to avoid hitting it.

Incidents such as these highlights the importance of a practical and effective Damage Prevention program that can achieve actual results and prevent similar tragedies from occurring in the future.

What can we do to improve safety moving forward?

Since nationwide implementation of the 811 program in 2007, there haven't been any significant large scale efforts to improve the effectiveness of Damage Prevention practices. This is especially concerning in light of the numerous advances in mapping, locating and information sharing technologies occurring over the past 8 years.

Additionally, PHMSA has not taken any action to articulate with specifics what steps states should take to meet each of the "Nine Elements of Effective Damage Prevention Programs". As a result,

PHMSA has not used any of the enforcement powers granted by Congress, including levying penalties and fines and withholding state grant funds.

Incorporate New Technologies into Best Practices and Regulations

First, the best way to eliminate or reduce the volume of incidents is to ensure that all parties have access to the best available information at an excavation site. There are a number of ways to do this. The CGA's Technology program serves a platform for industry participants to present new ideas and technologies to CGA's Technology committee.[16]

Recent presentations currently posted on the organization's website provide very strong examples of technological improvements, which if required in all states, would lead to significant improvements in information sharing.

Increase Accuracy of Share-ability of Worksite Maps Tools

For example, presentations from Questar [17] and Triglobal [18] demonstrate how GPS mapping technologies can increase the efficiency and accuracy of mapping a worksite. These mapping technologies are incredibly helpful, as they create a comprehensive record of information that can be digitally shared with all stakeholders, and stored for future use. Without the benefit of these technologies, excavators are left to use old surveys or maps, which may not even be accurate.

Utilize Enhanced Positive Response (EPR)

Another presentation summarized an EPR pilot program carried out by a wide-range of stakeholders. [19] EPR is similar to a positive response system, where the facility operator notifies the One Call Center, and consequently the excavator when the facilities have been located and marked.

However, in addition to the notification, the locator shares extensive worksite information with the excavator:

- Digital facility maps showing all facilities in relation to key markers on the worksite
- Original facility maps when available
- A virtual manifest
- Reference photographs of the worksite taken during the locate
- All project ticket data

These additional and easily shareable materials improve communication and ensure the excavator has the most accurate and comprehensive data set about the work site possible.[20]

The pilot was carried out to learn whether "providing excavators access to digital technologies (tickets, photos, facility maps and electronic manifests) would make the job safer, more efficient and reduce system wide damages." [21]

The results of the program were promising [22]

- **93 percent** of excavators and **88 percent** of facility owners involved said EPR made the jobsite safer
- **93 percent** of excavators and **72 percent** of facility owners said that EPR improved Damage Prevention

- System-wide damages were also reduced by **67 percent** from the same time period the previous year

These presentations do not cover the entire spectrum of technologies or best practices that can reduce instances of excavation damage, but they are illustrative of how new technologies can make the process safer. Federal and state regulators should look to these examples, and others, and be proactive in updating state requirements.

In doing so, states should not be over-prescriptive and foreclose upon the implementation of future technological advances. Rather, they should incorporate pro-technology, pro-collaboration principles that allow regulated parties to evolve with technology. They should however set minimum standards to ensure that regulated parties are not using 20th century technologies that do not sufficiently minimize excavation damage risk in the 21st century.

Federal and state governments need to update regulations and ensure that best practices are reviewed periodically. In doing so, they should consider the following:

- Requiring the use of GPS and electronic mapping technologies to more accurately map facility locations
- Enact or promulgate positive response requirements (many states already have)
- Require increased information sharing between all parties, i.e. facility operators, excavators and One-Call centers
- Require increased accuracy and quality of information shared, i.e. digital maps, original facility maps, more accurate jobsite descriptions

If these recommendations were implemented, excavators could compare the images and maps provided, and/or GPS coordinates to the markings left by locators to identify any potential inconsistencies when they reach the jobsite. Additionally, excavators could record where they install new facilities on digital maps, thereby improving the records and communications process going forward.

PHMSA Should Provide Detailed Guidance on Incorporating the "Nine Elements" and Make Full Use of Congressionally Authorized Enforcement Authority

Understanding that excavation damage is the leading cause of pipeline incidents in the U.S., Congress took a positive first step by creating nine elements that all damage prevention programs should incorporate. Congress also gave PHMSA the authority to penalize, fine, and withhold federal funds from states with insufficient programs.

While PHMSA promotes those nine elements, it hasn't taken any steps to provide states with guidance on what specific actions should be taken to fully incorporate each element. PHMSA should create a guidance document detailing actions each state should take to strengthen their Damage Prevention programs, including:

- Multiple concrete actions that would satisfy each of the nine elements
- Identify which parties should be held accountable for each concrete action (i.e. facility operators, locators, One-Call centers, excavators)
- Provide example of available technologies, systems, or best practices that regulated parties can use to achieve each requirement

In addition to these new requirements, states need to strictly enforce the regulations on the books and assess penalties accordingly. Stronger enforcement in the case of safety lapses alone will have the effect of promoting increased use of safety technologies. To ensure states are enforcing these improve rules and regulations, PHMSA should articulate which available enforcement tools they plan to use to enforce the new guidelines upon states (i.e. fines, penalties, withholding of funds), and strictly adhere to their enforcement plan.

Conclusion

With the vast network of underground facilities spread throughout the U.S., the risk of striking one during excavation will always be present. All stakeholders should work together to make sure that risk is mitigated to the largest extent possible, because when an incident occurs, damages can be very costly, and in the most unfortunate cases, deadly. While there are a number of ways to improve Damage Prevention practices, one of the simplest and most effective is to implement new technologies and keep excavation practices up to date to ensure the safety of all involved.

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[1] See Pipeline and Hazardous Material Safety Administration, Department of Transportation, "*Data and Statistics*," http://phmsa.dot.gov/pipeline/library/datastatistics/pipelineincidenttrends

[2] Ibid.

[3] See Pipeline and Hazardous Material Safety Administration, Department of Transportation, "*Damage Prevention*," https://primis.phmsa.dot.gov/comm/DamagePrevention.htm

[4] Ibid.

[5]The Pipeline Safety Improvement Act of 2002, Pub. Law 107-355 (2002).

[6] Common Ground Alliance, 811, http://commongroundalliance.com/programs/811#sthash.HVrPRhcC.dpuf

[7] See The Pipeline Inspection, Protection, Enforcement, and Security (PIPES) Act of 2006, Pub. Law 109-468 (2006).

[8] Pipeline Safety New Voices Project, "*Briefing Paper #7: Excavation Damage Prevention*," Pipeline Safety Trust: http://pstrust.org/docs/Briefing_Paper_DamPre07.pdf

[9] United States Department Of Transportation. Pipeline and Hazardous Materials Safety Administration. (2008). *Damage Prevention Assistance Program (DPAP): Strengthening State Damage Prevention Programs.*

[10] Ibid.

[11] Ibid.

[12] See Exponent Failure Analysis Associates. "*PG&E Line 118B Fresno In-Service Rupture Analysis*". 1 July 2015.

[13] See Mark, Benjamin. "*PG&E Files Claim against Fresno County in Pipeline Blast."* Fresnobee. 22 July 2015. Web. 23 July 2015

[14] Ibid.

[15] See Missouri Public Service Commission, “Staff’s Gas Incident Report,” February 6, 2014.

[16] See Common Ground Alliance, Programs, “Technology,” http://commongroundalliance.com/programs/technology

[17] Presentation can be found on http://commongroundalliance.com/programs/technology

[18] Presentation can be found on http://commongroundalliance.com/programs/technology

[19] The Group: Miss Utility, Washington Gas, Pepco, Verizon, NPL, R.B. Hinkle Construction, Lamberts Cable Splicing Company, CertusView and UtiliQuest.

[20] Presentation can be found on http://commongroundalliance.com/programs/technology

[21] Ibid.

[22] Ibid.

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X. Energy Efficiency, DG Enabler and a voltage solution in search of a regulator

By Maria Seidler

Decarbonization of the electric energy system requires action at both ends of the delivery system – generation and consumption, in the use of more lower- or zero-emitting energy generation and increased energy efficiency. This is a challenge at a time when demand for low-cost electricity grows to support our 21st standard of living. Electricity enables the digitalization of our commercial, financial and social institutions. Consequently, consumers' patience with electric outages grows shorter and the economic impact of long-term outages from severe weather events, regardless of whether one believes that climate change is a cause, are costs that everyone can agree our struggling economies can little afford. More distributed generation ("DG") and microgrids are perceived as answers to greater reliability, shifting the current system from reliance on large centralized generation resources to more localized and self-generation systems. While policy forces a shift of energy resources from the large transmission edge of the delivery system to behind the customer meters, policy has paid little attention to the distribution system that lies between. Yet, it is the distribution wires that will enable more distributed renewable energy and energy efficiency as resource solutions for carbon reduction and greater reliability and better valuation of these resources by facilitating their integration into the electrical energy system.

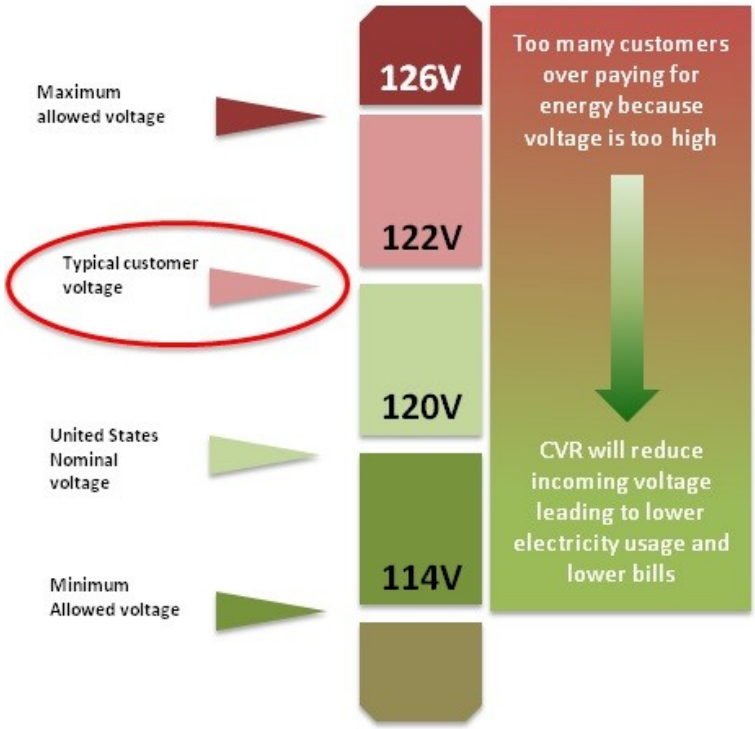
The vision of a "smart grid" that enables DG integration has evolved over two decades of regulatory discourse, and yet investment in the intelligence of the grid has progressed slowly. DOE has provided grants for almost one hundred smart grid pilot demonstrations, but the funding has failed to translate into significant commercial deployment of the technologies demonstrated. There is no federal investment tax credit to incentivize modernization of the grid as available to jump start solar investment leading to a proliferation of rooftop solar installations, with installations generally occurring on grids ill-prepared for the operational impact of the aggregated intermittency of solar. Government incentives have been committed to spur investment in renewable energy and energy efficiency for decades, and over the last few years, support has increased for distributed resources and microgrids. What has been lacking is an incentive structure for utilities to invest in smart grid technologies. In fact, most state regulatory cost-recovery, rate-based structures penalize utilities in adopting digital technologies that will benefit both the grid and its customers. Voltage optimization ("VO") is a case in point.

As described in more details below, VO technology offers an energy efficiency solution that can provide 3-5% energy savings from voltage reductions at the customer meter; a voltage stabilization solution that enables more intermittent distributed generation to be installed on hosting circuits; and a reliability and resiliency solution through automated voltage control that can detect and respond to voltage changes indicative of operational issues. Its energy savings support a business case, not only for its deployment, but also deployment of advanced metering infrastructure ("AMI"), which provides necessary functions for a modernized integrated grid design if behind-the-meter resources are to be assimilated within the electricity delivery system. VO technology is foundational to a modernized delivery system and offers operational, environmental and customer benefits that should make it a high-demand grid solution. All this begs the question, however, as to why it is not being widely deployed by utilities across the United States and other countries where energy efficiency and renewable energy are high priorities.

The answer is familiarly the same across jurisdictions. It is not in most utility's economic interest to reduce sales and lose revenue. Its distribution efficiency does not fit within the neat box of policy-supported energy efficiency programs that receive incentives or other form of favorable rate treatment, e.g. rider, which could offset lost revenues. Until regulators order its deployment or fix the lost revenue issue, utilities have no reason to change inefficient operating conditions that include voltage setting at conservative levels that delivers more kWhs than customers need, along with higher carbon emissions. The hope of this article is that if policymakers are educated on VO as (1) a best practice for energy efficiency, (2) a preparatory measure for greater solar DG penetration and integration into the distribution system, and (3) an cost-effective and expedient first step toward grid modernization without a need for a grand plan, they will work with utilities to remove regulatory obstacles for VO adoption, bringing to consumers the immediate economic and environmental benefits of a smart grid technology with the promise of more to come.

Voltage Optimization - A Best Practice of Distribution Efficiency:

In the U.S., the American National Standards Institute ("ANSI") sets the voltage standards across the energy systems. Diagram 1 shows the required range for voltage delivery at the customer meters. The range differs across countries. Voltage levels affect kWhs delivered. As depicted in Diagram 1, higher voltage levels results in higher energy consumption behind the meter. Reducing voltage means less energy consumed. Most U.S. utilities deliver voltage near 120V. CVR programs used over the past 20 years would use lower voltage settings as an emergency response to critical peak conditions by physically adjusting transformer settings at the substation level to affect delivery of energy within the lower one-half of the 10% voltage band. However, it is difficult to sustain lower settings for longer-term conservation results without knowing the voltage conditions on the primary circuits and at the meter.

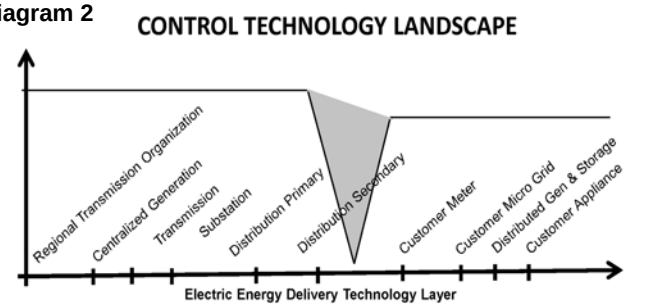


Because utilities lacking real-time operating information at the meter, they aim at 120V as a conservative target, to account for distribution line losses that could cause the voltage delivered to customers to drop below regulated levels. However, VO technology combined with the data collection and communication capabilities of AMI can manage voltage settings at the lower range indicated on the scale in Diagram 1 safely and reliably without any noticeable change in customers' equipment or appliance performance while producing long-term sustainable energy savings – 24 hours a day, 7 days a week. Further, while the technology is deployed on the grid-side of customers' meters, the energy savings are directly passed through to customers' electricity bills.

Because VVO would be a distribution efficiency program that does not require any change in customer behavior or initial investment by customers, it serves the public policy interest in expanding access to energy efficiency benefit to low-income customers. In its report on the results of its VVO pilot project funded by the DOE, Central Lincoln People's Utility District ("Central Lincoln") noted that all socioeconomic groups benefited as the saving occurred without regard to homeowner or renter status. In fact, the utility said that the "results of the pilot project were so impressive that Central Lincoln is undergoing plans for a full system wide implementation." [1] VVO as a grid-side energy efficiency program ensures equitable participation of ratepayers in its energy savings and environmental benefits, as well as the operational benefits gained through greater and expanded grid visibility.

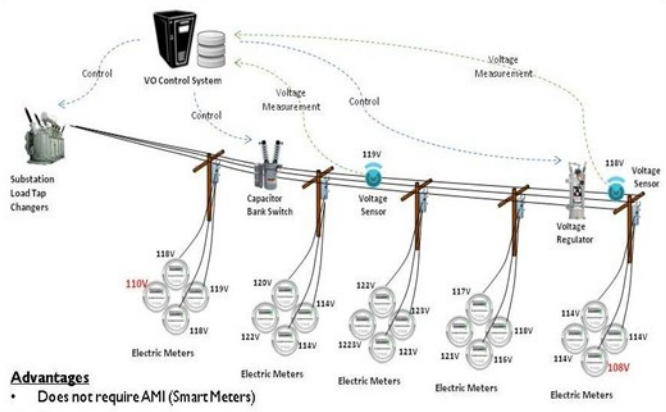
The technology approach to VO has critical importance to the level of potential energy savings and the kwH benefit to customers' bills. Conventional CVR relies on modeling of operational conditions on distribution circuits, but information used in modeling is limited to that associated with the primary circuits. Without more granular voltage data on secondary circuits down to the customer meter, distribution planning and operations must be based on assumptions from historical conditions, not real-time information. This data and communication dead zone represented in Diagram 2 is an obstacle to the efficient operation of the distribution system, both for energy efficiency savings and DG integration.

Diagram 2



A form of heuristic voltage management, depicted in Diagram 3, partially solves the problem as it provides more real-time voltage data, but still requires some modeling implementation. While automated voltage controls respond to actual voltage data collected from sensors along primary circuits, it offers no communication bridge to address this dead zone issue. Further, the sensors' particular placement on the primary circuit is determined by modeling using historical data and therefore, their location may not be optimal for managing real-time conditions. Further, because the operator still has no real-time operating information at the customer meter, the voltage range of the automated response must be set conservatively to provide a reliability margin to avoid for possible voltage issues that might otherwise cause voltage at the customer meter to drop below the ANSI minimum. Thus the saving opportunity is limited. In addition, while this primary circuit, sensor-based VO technology can provide 1.5% to 3% energy savings, because the conservation voltage reduction occurs on primary circuits, the benefit accrues to the distribution system, with minimal savings to customers' bills.

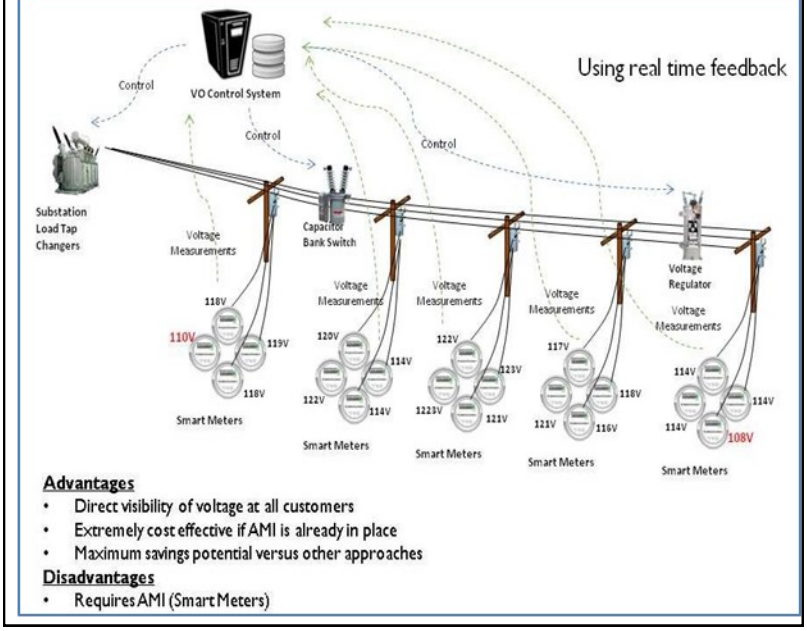
Diagram 3



Optimal voltage management, illustrated in Diagram 4, uses existing voltage regulation equipment with a more

precise set point control that processes customer data to improve accuracy and provide the adaptive capability. Consequently, AMI enables tighter voltage control by collecting the needed customer voltage readings that the VO software uses to set point changes and instructs the Distribution Management System (DMS) or SCADA to control the local substation LTC controller, circuit voltage regulator and/or capacitor. The technology also allows set point control for down-line regulators and capacitor banks through distribution automation systems. Adaptive control using AMI allows near total automatic response to the typical dynamic circuit environment, allowing safe reliable delivery of energy to the customer at lower voltage settings with sustainable energy savings. Because voltage management occurs on secondary, as well as primary circuits, the energy saving potential almost doubles to 3% to 5%, depending on the load characteristics of customers' appliances and equipment behind the meter. Finally, because the voltage is controlled to the customer meters, customers are the primary beneficiary of the energy savings. 95% of the energy saved through AMI-enabled VO shows up on customers' bills.

Diagram 4



For all the above reasons, the VO solution has broad organizational support. The National Association of Regulatory Utility Commissioners ("NARUC") adopted a *Resolution Supporting the Rapid Deployment of Voltage Optimization Technologies* ("Resolution"), recognizing VO's immediate, predictable and measurable energy savings benefiting customers and the environment, as well as identifying it as an important component of grid modernization. The Resolution encouraged regulators to solve the lost revenue issue to encourage VO deployment.

Also significantly, the U.S. Environmental Protection Agency ("EPA") recently discussed VO advancements in its *Guide to Action* when identifying VO as a best practice for energy efficiency and in the final rules to the Clean Power Plan ("CPP") for carbon regulation, it endorses the distribution efficiency of VO as a compliance pathway to achieve a state's carbon goal in its state implementation plan [3]

Voltage Optimization – A Business Case for AMI

A business case for deployment of a combined AMI and VO technology solutions is somewhat utility-specific and dependent on the future power purchase costs of its regional wholesale market and the market price of the AMI technology available to the utility and the associated maintenance services. However, in order to illustrate the general cost/benefit of AMI-enabled VO and persuade regulators to explore a more specific cost/benefit analysis for deployment by its jurisdictional utilities, the graph in Diagram 5 below was developed based on the following assumptions:

- AMI-based VO is deployed on circuits comprising a load of 61m MWHs.
- A conservative average of 3% VO reduction in usage.
- A wholesale power price of $48.95/MWH (based on 2014 PJM average wholesale prices).
- Average Meter installation and service costs of $125 per meter.

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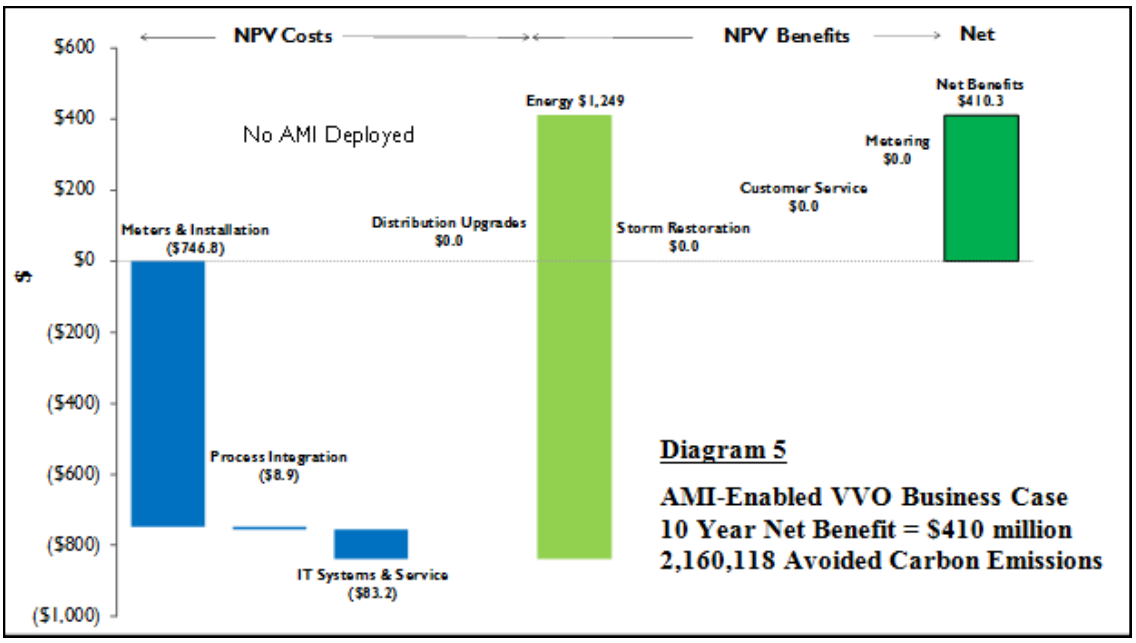


As a result of VO's distribution efficiency, the hypothetical utility would avoid the purchase of 2.8m MWHs per year with a cumulative value of $1,249m. After paying the sunk cost of $747m for the AMI system, the net benefit to customers over a ten year timeframe, based on net present value, would equate to $410m, excluding any valuation for reduced capacity needs, or the 2,160,118 tons of annual avoided carbon emissions reduction, or similar benefits from NO_x or SO_2 reductions or ozone compliance.

AMI also provides other benefits as a result of its remote connection and disconnection capability and remote meter readings with its billing advantages. However, these benefits accumulate more to the utility and the cost savings have not been as convincing to customers who question the advisability of AMI. In Minnesota, for example, public pressure caused the legislature to request that any AMI program adopted would require customers to opt-in. AMI election does little for advancement of an intelligent grid and the integration of customer-owned DG and home energy management systems. However, customers get to experience the real value of AMI capabilities as part of a combined AMI-VO program that delivers energy savings directly to customers' bills and delivers voltage at a more efficient level that help increase the life usage of the customer's energy efficient appliances. As one state commission staffer was heard to exclaim– this is what AMI is suppose to be about.

Voltage Optimization – A Renewable DG Enabler

Voltage management is also key to addressing grid stability issues associated with increasing penetration of intermittent and non-dispatchable renewable DG. For example, when solar DG on multiple rooftops is interrupted, the result can be a severe voltage drop below the engineering standard, affecting all customers along the affected circuit. As the clouds move past the neighborhood, and all that generation comes back on, voltage on the circuit can surge above the

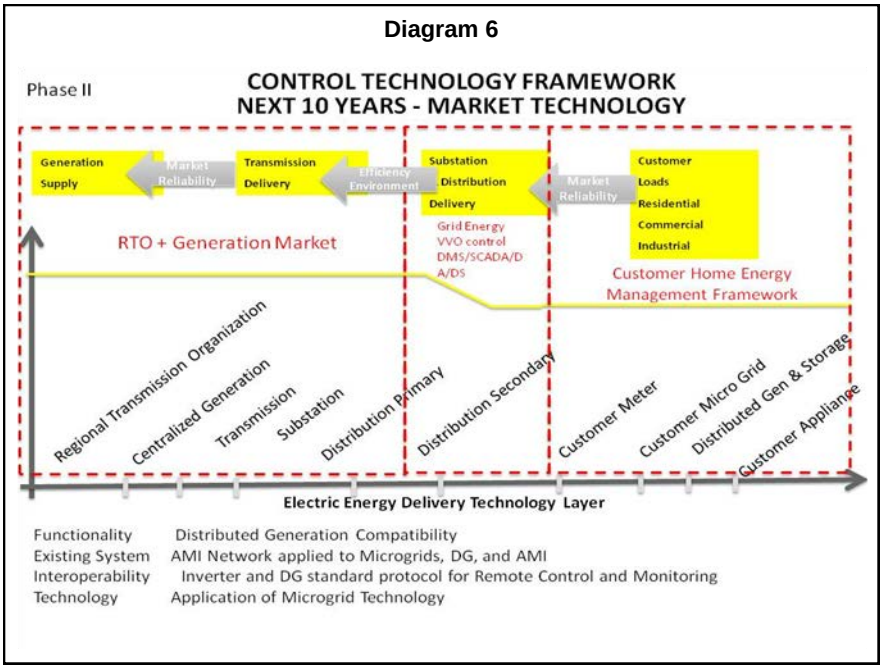
maximum standard, endangering the stability of the grid, reaching into the home and endangering customers' appliances and electronics. In addition, high voltages can occur during high solar generation on circuits with light loads.

Automated voltage management platforms can easily be adapted to address the volatility of these voltage fluctuations. Voltage stabilizing software module can provide solar DG monitoring using AMI voltage data or data collected from smart inverters. It will create voltage profiles for solar homes or businesses, and then, using the same voltage automated control of its VO software, manage the secondary circuit's voltage based on the voltage profile. The voltage control safely and reliably mitigates the affects of cloud transience and helps maintain circuit stability. In addition, when VO technology includes monitoring and planning modules, which some voltage control platforms offer, the data it collects can inform the decision-making process for planners and operators in modernizing the distribution system so that it is prepared to accommodate the inevitable upsurge of variable renewable DG penetration. Voltage stabilizing software can increase the hosting capacity of distribution systems, enabling greater solar DG installations.

Voltage Optimization: The Cost-Effective and Expedient Groundwork for Grid Modernization

As noted earlier, grid communication capabilities generally ends at the substation parameters, leaving grid operators blind as to the operating conditions on the secondary circuits of most distribution system. AMI and smart inverters' data collection and two-way communication capabilities with VO automated control software serve as a first step to grid modernization, while being funded by the energy savings of VO distribution efficiency. This can happen without waiting to develop and implement complex grid modernization plans. Secondary circuits are transformed from their current dead zone status to a communication and operational extension completing the bridge between the control room and the energy appliances and equipment behind the customer meters. VO platforms can serve as the technological groundwork for later phased-in automated controls, as represented in the future control technology framework in Diagram 6 below that will result in a modernized integrated electrical delivery system.

Diagram 6



Public utility commissioners have historically been economic regulators using economic accounting frameworks. Some jurisdictions have modified regulations to use performance-based rates and decoupling to unlink utilities' earnings from sales revenues that served to disincentivize efficiency programs. However, VO as a distribution efficiency solution continues to face this revenue challenge. VO is a best practice for energy efficiency that deserves similar rate advantages as its energy efficiency compliment of behind-the-meter customer-based programs.

References

[1] Central Lincoln, *Voltage Management at Central Lincoln PUD,"* Smart Grid Investment Grant 2014 Report Project ID 09-0269, attached to these Comments as Exhibit 2.

[2]National Association of Regulatory Utility Commissioner (NARUC), EL-2/ERE-3 *Resolution Supporting the Rapid Deployment of Voltage Optimization Technologies*, (November 14, 2012); can be found at http://www.naruc.org/Resolutions/Resolution%20Supporting%20the%20Rapid%20Deployment%20of%20Voltage%20Optimization%20Technologies.pdf,

[3] EPA, Final Rule, *Carbon Pollution Emission Guidelines For Existing Stations Sources Electric Utility Generating Units* ("Final Rule"), unofficially issued Aug. 3, 2015at p. 1031. See also ftnote 965 that describes voltage volt optimization (VVO) as a technology advancement of CVR: Volt/VAR optimization (VVO) refers to coordinated efforts by utilities to manage and improve the delivery of power in order to increase the efficiency of electricity distribution. VVO is accomplished primarily through the implementation of smart grid technologies that improve the real-time response to the demand for power. Technologies for VVO include load tap changers and voltage regulators, which can help manage voltage levels, as well as capacitor banks that achieve reductions in transmission line loss. VVO efforts are often closely related to CVR, which are actions taken to reduce initial delivered voltage levels in feeder transmission lines while remaining within the 114 volt to 126 volt range (for normal 120-volt service) required at the customer meter, per the ANSI C84.1 standards.

Maria Seidler

Maria Seidler has 30 years of legal and business expertise with several major energy companies working with federal and state regulation of natural gas, electricity, and renewable energy, and in electricity, gas and environmental products transactions. She has represented clients before the Federal Energy Regulatory Commission (FERC) and has advised state legislators and regulators in industry restructurings. As AES Director of Policy, she advises on state energy issues from rate design to renewable energy and efficiency programs. She has her *Masters in Environmental Management* from Yale University and *Law Degree* from the University of Tulsa.

XI. Electricity markets are being challenged

By Stephen Woodhouse and Kostas Theodoropoulos

Electricity markets are being challenged

In the liberalised electricity markets across Europe, national monopolies for electricity supply have given way to electricity markets with separation between competitive and monopoly elements. Investment in new generation capacity has been based on expectations of spot prices in 'energy only' markets, with the potential for scarcity prices at times of inadequate supply. The foundation for investing in new generation capacity was a predictable operating pattern for new assets. New and more efficient capacity was expected to have close-to-baseload operation for most of its lifetime, with older plants acting in mid-merit and peaking roles. The main commercial risks related to price risk, primarily as a result of fuel (and more recently CO_2) prices. This price risk could be managed through forward contracting or vertical integration, and more risk-averse investors could secure lower risk deals through long-term tolling or power purchase agreements. This investment paradigm managed to deliver generation adequacy for many years, but is now being challenged. Relatively new gas fired power stations are being taken out of service, and TSOs in many parts of Europe are looking nervously at security margins as unprofitable plants close. What has changed?

In Europe, a sustained reduction in demand due to energy efficiency and the prolonged impact of the financial crisis has been coupled with a strong increase in weather variable renewable generation, principally wind and solar. Renewable output is unpredictable, and its contribution to peak demand is disproportionately low compared to its overall energy output. This has an impact on conventional generation. Baseload operation is no longer a reality, and there is greater reliance on peak (scarcity) pricing to recover fixed and investment costs. However, renewable generation contributes to some (but not all) of the demand peaks, making peak periods more infrequent. In an 'energy-only' market fixed and investment costs would need to be recovered from fewer periods with extremely high prices.

This increased price risk is compounded by volume risk, which arises from far less predictable operating patterns, posing a significant challenge for investors and giving rise to scepticism about the ability of 'energy-only' markets to attract investment. The standard market contracts – for firm patterns of delivered energy – do not give market participants appropriate tools to hedge their risk through forward contracting. Such a combination of price and volume risk is dealt with in other commodity markets by trading options, but options are not widespread in European energy markets. Irrespective of whether they face 'missing money', European energy markets appear to have 'missing contracts'.

Energy companies in Europe are facing their own financial crisis. The Economist had a notable cover page quoting a reduction of half a trillion dollars in the stock value of European energy companies, and margins of power prices over fuel costs are at historically low levels. Many (including EURELECTRIC, the European electricity association) are now loudly advocating the need for a separate market to reward capacity. This notion has been supported by policymakers in some countries, and Capacity Remuneration Mechanisms ('CRMs') are now a reality in some main European markets; including Great Britain, Spain and Italy, with advanced designs in place in France and Ireland and heated discussions in Germany.

Yet this outbreak of CRMs is in the face of strong agreement by all stakeholders to complete the Internal Market for Electricity, which aims at promoting trade across borders (based on market coupling through spot energy prices). There is a concern that top-up capacity products will distort energy pricing and undermine the market coupling. The capacity mechanisms to date are each national and very different in design and – it is feared – will undermine the operation of the integrated European electricity market. The European Commission has launched a Sector Enquiry into the operation of capacity mechanisms.

The existing and proposed CRM designs have a narrow definition for qualifying capacity, failing to reward flexible capacity that is key to the operation of systems with increased weather variable renewable generation. Focus of CRMs has traditionally been on generation adequacy, meaning ensuring that sufficient capacity is on the system to meet peak demand. In order to incentivise the right type of capacity markets in a world with increasing levels of weather variable generation, CRMs will need to be able to cope with emergent system performance requirements, and in particular should consider flexibility as one of the parameters of their design.

Is there another solution? Is there a design that does not undermine the concepts of the Internal Market for Electricity, rewards the right types of capacity, but also provides the right hedging tools for investors? This design should have two key characteristics: it should be generic enough to adopt in any market (without requiring all markets to adopt the CRM); and it should complement the spot electricity markets as a hedging instrument, rather than acting as a supplemental revenue stream. Ultimately, capacity is an option to deliver energy. Options vary in value dependent on the exercise price and also the notice period. It is not true (as often asserted) that all available capacity has the same value. More flexible capacity is likely to make a higher contribution to system security and should be rewarded accordingly.

In the integrated European markets, a common approach for rewarding capacity would be highly beneficial, if distortions in the energy markets can be minimised. This design needs to maintain the positive aspects of CRMs, providing greater investor certainty, and minimise the undesired consequences, price and trade distortions.

Decentralised Reliability Options – A common blueprint

To meet the requirements of the European market, we have outlined a novel form of CRM, Decentralised Reliability Options ('DROs'), which could be introduced in selected markets if a capacity mechanism is considered necessary by policy makers. DROs could serve as a risk management tool for investors and market players; without distorting peak pricing, demand side management or cross border energy trading. The European markets are (almost all) decentralised, with physical trading over a range of times until physical delivery. The decentralised concept for ROs supports this fundamental design feature, and allows flexibility to be valued.

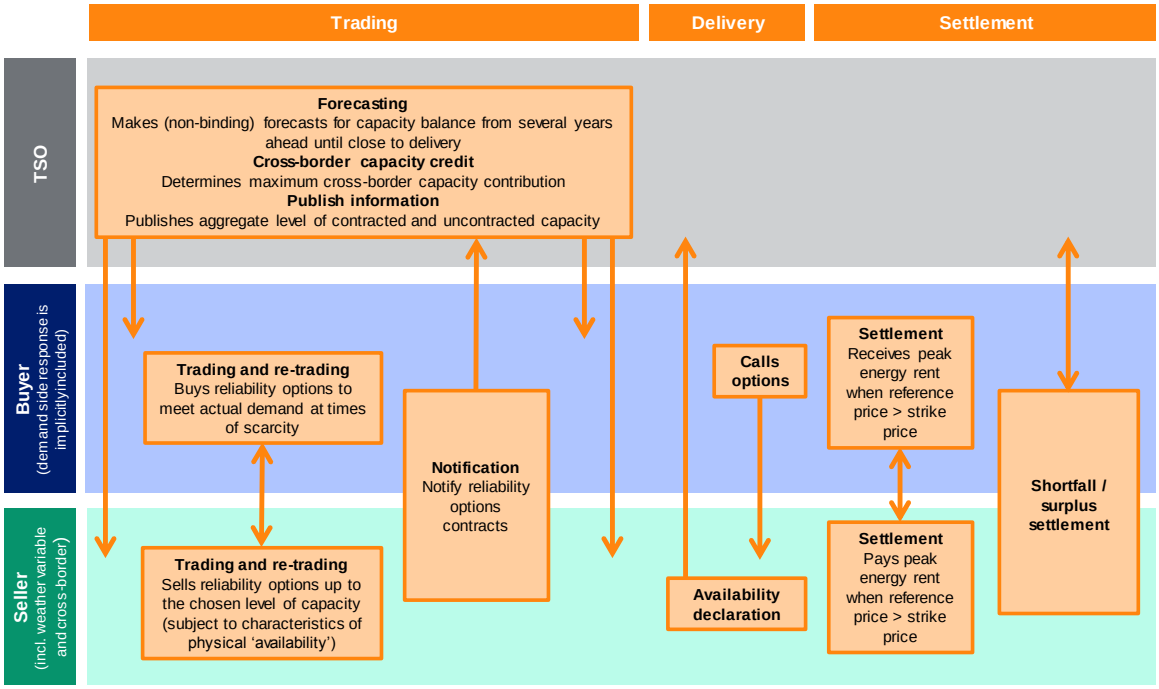
DROs take the form of a market-wide, quantity-based scheme for valuing capacity. 'Quantity-based' schemes are structured around a need for a certain level of capacity that is then procured or traded competitively. By 'market-wide' we mean that all qualifying capacity can participate. However, unlike other market-wide schemes that treat all capacity equally, DROs allow capacity to be valued based on the market need for flexibility. This can be achieved by decentralising the obligation and allowing the products to be defined and traded according to the risk management needs of market players.

DROs introduce a set of option contracts between capacity providers and retailers. An obligation is placed on retailers (buyers) to buy ROs to meet their demand at critical times. Capacity providers (sellers) in their turn commit their availability at critical periods and forego revenue from price spikes, in return for an upfront, stable revenue stream. The ROs each have a strike price and a reference market (negotiated between the parties or set in standardised products). The value of each option will depend on the reference market, strike price, and other contract terms.

The RO contracts are hybrid in nature. They combine a commercial call option with a physical commitment to make capacity available to the system. The call option introduces a financial settlement, whereby the seller of the option returns the difference between the reference market price and the strike price, if any, to the buyer. Buyers benefit from security of supply to an agreed standard, and their exposure to scarcity pricing is reduced in return for an up-front fee.

An outline design for a DRO scheme is presented in Figure 1.

Figure 1 – Straw man design of Decentralised Relability Options scheme



Although the scheme is decentralised, the TSO still has an important role. By providing forecasts and information on its view of the capacity balance from several years ahead until close to delivery it can aid transparency and support price discovery. Such forecasts do not however act as an obligation, which ultimately lies with retailers. It is only the estimate of cross-border capacity contribution that lies fully within the TSOs' remit. The TSO is responsible for estimating the level of cross-border capacity contribution to the local system over stress periods.

Retailers are required to buy sufficient ROs to meet their actual demand at times of scarcity (perhaps with a TSO-defined margin). Retailers must forecast their demand, and are free to contract as much capacity as they wish at their own risk. This structure allows for demand side response to be implicitly included, as retailers can seek to reduce demand at critical periods.

Capacity providers sell ROs based on their actual contribution to system capacity at times of scarcity. Similarly to retailers, they can choose the level of reliable capacity to sell, at their own risk. Their physical contribution is measured against pre-agreed characteristics relating to 'availability' of the contracted capacity.

The buyer holds a call option with an agreed strike price against a reference market. Other terms of the option include the expiry time and the duration of the contract. The option holders are hedged against price spikes above the strike price. Sellers forego peak market revenue, which is returned to the option holders, in exchange for an upfront payment, the option fee.

In addition to the commercial settlement of the option, administered penalties are applied at critical periods both for under-procurement by retailers or under-performance by capacity providers; with equivalent payment for any over-performance. This is facilitated by a central agency (perhaps the TSO), which records all RO contracts. Contract notification is allowed even after the event to enable market participants to resolve capacity shortages or surpluses bilaterally.

RO contract terms would be largely agreed bilaterally between buyers and sellers, although an effective set of trading could occur using standardised products traded through an exchange. Due to the importance of the Day-Ahead market, ROs could take the form of a financial option against the Day-Ahead price, but firm physical forward energy trades, physically settled options for intraday delivery or financially settled options against the imbalance price would also be permitted. Strike prices could be either fixed or indexed against fuel or electricity price indicator and would potentially be capped at a centrally determined strike price level.

Participation in the scheme is not restricted to a set of technology types or providers within a given bidding zone. Cross-border participation is permitted. This would be possible however assuming providers have secured an agreement from the cross-border capacity owner for using the capacity. For example, holding a transmission right would meet this requirement, but other options may be possible. The amount of cross-border capacity that can be used will however be limited to the TSOs' contribution estimates at stress periods.

Decentralised Reliability Options – What are the advantages?

CRMs must meet both policy and commercial objectives. Assessing market designs can sometimes be subjective. It is important to identify the implications of a design on different objectives. From this, each commentator can then draw his own conclusions about the attractiveness of the design.

The European Commission has set out the key requirements of CRMs in the form of guidelines (including legally binding State Aid guidelines). These requirements deal primarily with the efficiency of the scheme within the context of the Internal Market for Electricity. In addition to being efficient, a scheme also needs to be effective.

To aid the comparison of the two main aspects of a DRO scheme, the 'penalty' arrangements and procurement, we make two comparisons: firstly ROs against conventional capacity tickets, and then centralized against decentralized ROs.

ROs deliver security of supply, protect consumers and can help avoid energy price distortions

Most market-wide CRMs are intended to supplement 'missing money' but without addressing the underlying causes which limit or prevent scarcity prices. These limits – where they exist – are generally measures to protect consumers from price shocks or poor reliability. Unlike capacity tickets, ROs legitimise price spikes. In fact, it is the expectation of such price spikes that reveals the option value. ROs create a supplementary revenue stream to deliver missing money (as for other market-wide CRMs), but the inclusion of the commercial option has an important influence:

- customers are protected from scarcity prices in the spot market; and
- spot price volatility can be hedged by the seller through the sale of the option in a "fixed-for-floating" swap of revenues, lowering the risks and cost of capital for new investment.

These two effects mean that an RO scheme can reduce missing money from the energy market both indirectly and directly. ROs put in place the customer protection which permits the regulators to remove any underlying distortions to energy price formation. If this is done, price volatility will reveal the value of demand side management, interconnection and intraday flexibility.

Under an RO scheme with both a commercial obligation as well as additional penalty arrangements, there is a double incentive to deliver when compared to capacity tickets where the penalty is the main driver for compliance. This means security of supply is further enhanced when compared to capacity tickets.

From a consumer perspective, ROs remove the incentive for generators to exercise market power over periods of scarcity; and offer a hedge to consumers through direct compensation over periods of short-term price spikes. Capacity tickets, on the other hand, present the risk (in the short term) of overpayment as; in the absence of regulatory measures to limit price spikes, generators may attempt to exercise market power over periods of scarcity in addition to receiving the upfront capacity payment.

On the other hand, ROs present a more complex solution when compared to capacity tickets and may perceived as 'riskier' by investors as both a penalty and a commercial incentive for performance are in place.

Ultimately, the benefits of avoiding distortion of competition and trade, protecting consumers and better facilitating innovative technologies may outweigh the downsides of a reliability options scheme. Table 1 shows our appraisal of capacity tickets against ROs.

Table 1 – Comparison between capacity tickets and reliability options

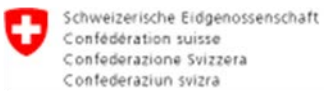
Criteria	Capacity tickets	Reliability options	Comment
Security of supply	✓	✓	ROs provide for stronger incentives for capacity providers to perform as both a penalty and a commercial incenti
Internal Market for Electricity	✓	✓✓	Capacity tickets risk damaging the underlying energy price signals at times of scarcity, limiting effectiveness of d interconnection. ROs allow for the removal of regulatory interventions, which could result in energy market price protecting consumers. Both options could provide for cross-border participation
Technology neutrality	✓	✓✓	ROs protect the underlying energy price signals and avoid price distortions, better facilitating demand side respo easily adapted to appropriately reward flexible capacity
Competition	✓	✓	Both schemes allow for competition within the scheme. ROs, however, better facilitate competition in the energy limiting energy price distortions over scarcity periods
Efficiency	✓	✓✓	ROs have the potential to deliver a more efficient outcome in terms of capacity on the system by allowing option ent parameters (strike price, duration and expiry time). ROs protect consumers, making explicit regulatory set pr
Efficient cost allocation	✓	✓	Both schemes should aim at targeting costs associated with funding capacity contracts over periods of scarcity a the consumers contribution to demand over peak periods
Simplicity	✓	✘	ROs are more complex than tickets as option settlement has to be considered
Distributional effects	✘	✓	With capacity tickets there is a risk of overcompensation towards generators (paid by consumers), limited in the is direct compensation for short-term price spikes
Bankability	✓✓	✓	In both schemes, penalties should be strong enough to incentivise performance but should also be manageable. both a penalty and a commercial incentive under ROs may present additional risk for investors
Robustness and adaptability	✓	✓✓	Both schemes require regulatory intervention and centrally determined parameterisation. ROs provide for flexibil reward capability more appropriately and can more easily be adapted to meet national needs.

Stephen Woodhouse, Director, heads Pöyry's Market Design group, dealing with energy policy, regulation and market design, for clients across Europe and beyond. He is an expert in market reform, from high-level design, implementation of systems and processes and the commercial and strategic response to change.

Stephen's work focuses on integration of renewables, valuing capacity and flexibility, smart energy and demand services. He is an active contributor to the debate on future market design and new business models for energy companies. Stephen has an MA in economics from the University of Cambridge.

Kostas Theodoropoulos, Senior Consultant, is an expert in electricity market design and analysis. His work focuses on the development and assessment of electricity market designs and market and regulatory advice for investment in the electricity supply chain.

Kostas is advising organisations across Europe on the implementation of the EU Target Model, and other innovative approaches for the future electricity markets. He has an MSc in Sustainable Energy Futures from Imperial College London and an MSc in Applied Mathematics and Natural Sciences from the National Technical University of Athens.

XII. ICER PUBLICATIONS

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ICER's Virtual Working Groups prepare reports on various topics such as Reliability and Security of Supply, Smart Meters, Consumers, Market Integration, Managing Investment Uncertainty, etc.

Find all published reports in ICER's publications section (http://bit.ly/1HZKU2b).

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2015 Winner in the category "Impact on Developing Countries," *The Role of Microgrids within Future Regional Electricity Markets* by Dr. Katelijin Van Hende and Ms. Carmen Wouters

2015 Winner in the category "Next Practice," *Capacity Remuneration Mechanisms in the Context of the European Internal Energy Market* by Mr. Carlos Batlle, Mr. Pablo Mastropietro and Dr. Pablo Rodilla

2012 Winner in the category "Impact on Developing Countries," *Development of New Infrastructure and Integration of new Technologies in Guatemala* by Carlos Eduardo Colom Bickford, CNNE Guatemala

2012 Winner in the category "Next Practices," *Changing the Regulation for Regulating the Change* by Luca Lo Schiavo, Maurizio Delfanti, Elena Fumagalli and Valeria Olivieri

2010 Winner in the category "Next Practices," *Pricing of Ancilliary Services and the Impact of Wind Generation on the Capability of the Transmission Network* by Darryl Biggar

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