INQUIRY INTO THE TRUE VALUE OF DISTRIBUTED GENERATION
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Distributed generation can be addressed by the government in several ways.

Health and Environmental Externalities –

Distributed generation has significant impacts on reducing health costs for the community and addressing climate change as well as benefits that arise from increased community involvement in generating its own power. This should be reflected in the price received for generating renewable energy and storing it. A Tariff should be introduced to reflect this.

Virtual Net Metering

Victoria should adopt net metering in order to encourage the adoption of solar energy and other distributed generation. This will increase the amount of community energy projects and the associated benefits that go with them. It will give consumers more choice.

Frequency Regulation

The emergence of high penetration of renewable energy sources in the energy mix of power systems ha substantially increased the need for faster-ramping resources participating in the frequency regulation service procured via market mechanisms by the System Operators. However, current market mechanisms do not properly align the incentives for participation since resources are not compensated for the actual frequency regulation they provide nor for the accuracy with which they follow the Automatic Generation Control (AGC) dispatch signal. A "Pay For Performance" tariff similar to the USA should be introduced in order to incentivise fast ramping frequency control services such as batter storage and flywheels. This will increase the efficiency and availability of the network and allow renewable energy to be more easily integrated into the network (a)

a. http://www.ferc.gov/whats-new/comm-meet/2011/102011/E-28.pdf

1. HEALTH COSTS

Victorian coal power stations are causing billions of dollars of health and environmental damage, research out of Harvard University has found.

The new figures are based on the externalised social costs for electricity generators in Victoria, and estimate that brown coal generators in the Latrobe Valley are each causing between $500 million and $1.2 billion dollars worth of damage a year.
Source: Cleaning up Victoria's Power Sector: the full social cost of Hazelwood power station. Harvard Kennedy School of Government. February 24th 2015
https://issuu.com/environmentvictoria/docs/social_cost_of_victorian_coal_plant

2. VIRTUAL NET METERING

Source: http://blogs.edf.org/energyexchange/2014/10/30/5-reasons-virtual-net-metering-is-better-than-plain-ol-net-metering/

Victoria should adopt net metering in order to encourage the adoption of solar energy and other distributed generation. Sometimes referred to as “running a meter backwards,” net metering allows people to generate their own electricity, export any excess electricity to the grid, and get paid for providing this excess energy t the utility who may use it to power nearby homes or manage overall electricity demand.

Net metering leads to lower – or in some cases negative – electricity bills without having to invest in expensive batteries to store excess energy, which can be cost-prohibitive. By generating energy on-site wher it’s consumed, net metering also reduces the strain on distribution systems and cuts the amount of electricit lost to long-distance transmission and distribution (estimated at seven percent in the U.S.). Net metering, moreover, tends to reduce greenhouse gas emissions by incentivizing people to adopt renewable energy and become more aware of energy-saving opportunities.
A few places are now talking about “virtual” net metering. The term “virtual” may be confusing, but it essentially means customers can receive net metering credits for projects even if they are not on their property. An example would be a group of neighbors receiving such credits for a community solar project.

Virtual net metering offers many advantages, even over its more common cousin, including:

1. **Optimized siting for solar and distributed energy projects**

Rather than being limited to a single roof that might be tilted away from the sun or covered by trees, installers, investors, and customers can choose the most productive sites, making for a better investment with higher financial returns.

2. **Additional financing options, plus options for renters**

A “virtual” project also enables creative project financing, perhaps through crowd funding or third-party ownership. It also allows renters and other non-homeowners to invest in energy projects. For example, California’s Multifamily Affordable Solar Housing (MASH) Program has led to 20.5 megawatts of solar capacity interconnected across 323 projects that serve 6,371 affordable housing tenant units.

3. **Economies of scale, which lower costs**

Virtual net metering enables larger project developments, while also minimizing costs associated with hous alterations and project maintenance. Larger projects allows for an economy of scale which lowers costs for everyone involved (i.e. the greater the quantity of a good produced, the lower the per-unit fixed cost becaus these costs are shared over a larger number of goods). The Lawrence Berkeley National Laboratory (LBNL)calculated that the installed cost of solar drops over 30 percent when moving from a 2 kilowatt syste to a 10 kilowatt system. Economies of scale also may allow investors and developers to target construction o cheaper property areas, the value of which may vary widely within a utility service territory, further adding t a project’s financial incentive.

4. **Expedited project development**

Virtual net metering can streamline the interconnection application and review process for both utilities an customers. Compared to applications from multiple residents with rooftop solar, a community project woul require a single filing, saving both time and money.

5. More profitable compensation rates

Virtual net metering, particularly for solar projects, allows more customers – not just those with solar panel on their roofs – to take advantage of a utility's dynamic retail electricity rates that offer higher prices during peak periods in warm summer months, which coincide with maximum solar electricity production.

By adding "virtual" to a tried-and-true concept, we can expand the benefits of solar and other clean distributed-generation projects to more people. This expansion also offers "real" reductions in both costs an pollution.

FREQUENCY REGULATION

Source: http://www.cleanhorizon.com/blog/2013/09/frequency-regulation-the-need-for-fast-responding-assets-and-the-mileage-case-in-the-usa/

A gap between power generation and demand on the grid causes the grid frequency to move away from its nominal value. This grid frequency is the same everywhere on an interconnecte grid, for instance 50 Hz in Europe and 60 Hz in the USA, and must remain as close as possibl from this value.

When demand momentarily exceeds generation, the missing energy is supplied by the kinetic energy of the generators' rotors: the synchronous machines slow down, and so does the grid frequency. The same happens when a plant goes down. On the opposite, if generation is greater than the load, the grid frequency increases.

Rotating machines are manufactured in order to work best within a given frequency range. So goes out of bounds, typically ± 0,5 Hz around the grid nominal value, machines disconnect the avoid damages, and blackouts can occur.

To avoid this scenario, **automatic regulation mechanisms** have been created. The network operator holds in store active power capacity made available by producers, which can be activated at any time to bring balance to the grid. In Europe, this scheme is divided between the **primary reserve** that stops the frequency drift in case of an event (e.g. a plant going dowr and the **secondary reserve** that brings the frequency back to its nominal value.**Tertiary**

reserve can solve longer-term (a few hours) imbalances. These three reserves are part of a larger network safeguard called **ancillary services.**

In case of normal grid operation, the frequency drifts are small and solved directly by the primary reserve.

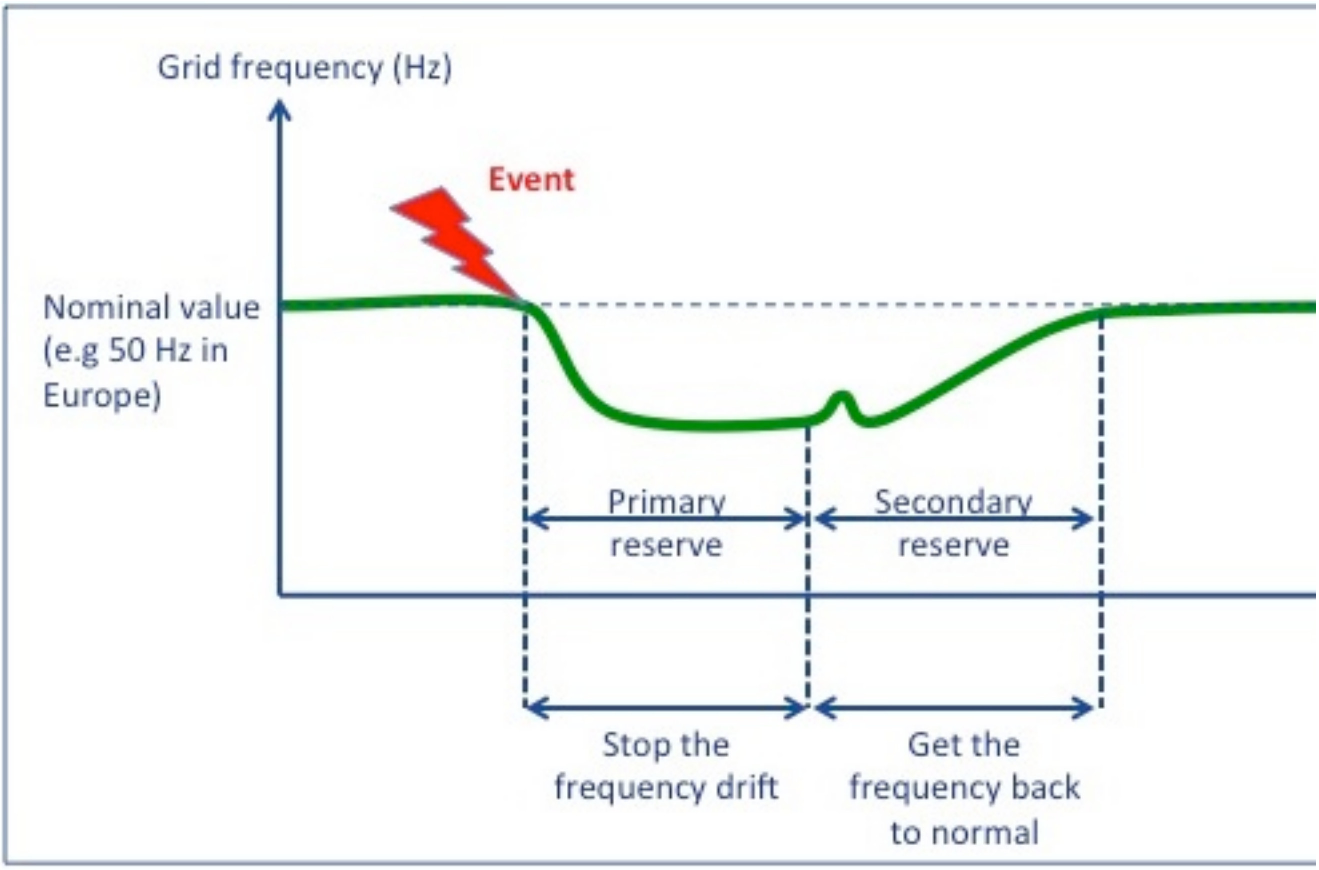

Figure 1: frequency regulation with primary and secondary reserves

In some countries, such as France, producers are bound by law to make available a small amount of thermal or hydro capacity for frequency regulation. This mandatory service is compensated through a bilateral contract (18 €/MW/h for primary reserve in France). In other countries, reserve capacity is procured through a market auction.

A question arises: are thermal power plants (called “slow assets” hereafter) the optimal assets for regulating a frequency with a high variation rate? (see figure 2). Would flywheels and batteries (“fast assets”) not be a better solution, with their response time under 1 second? The “Pay for performance” scheme ongoing in the USA brings some answers to this important issue.

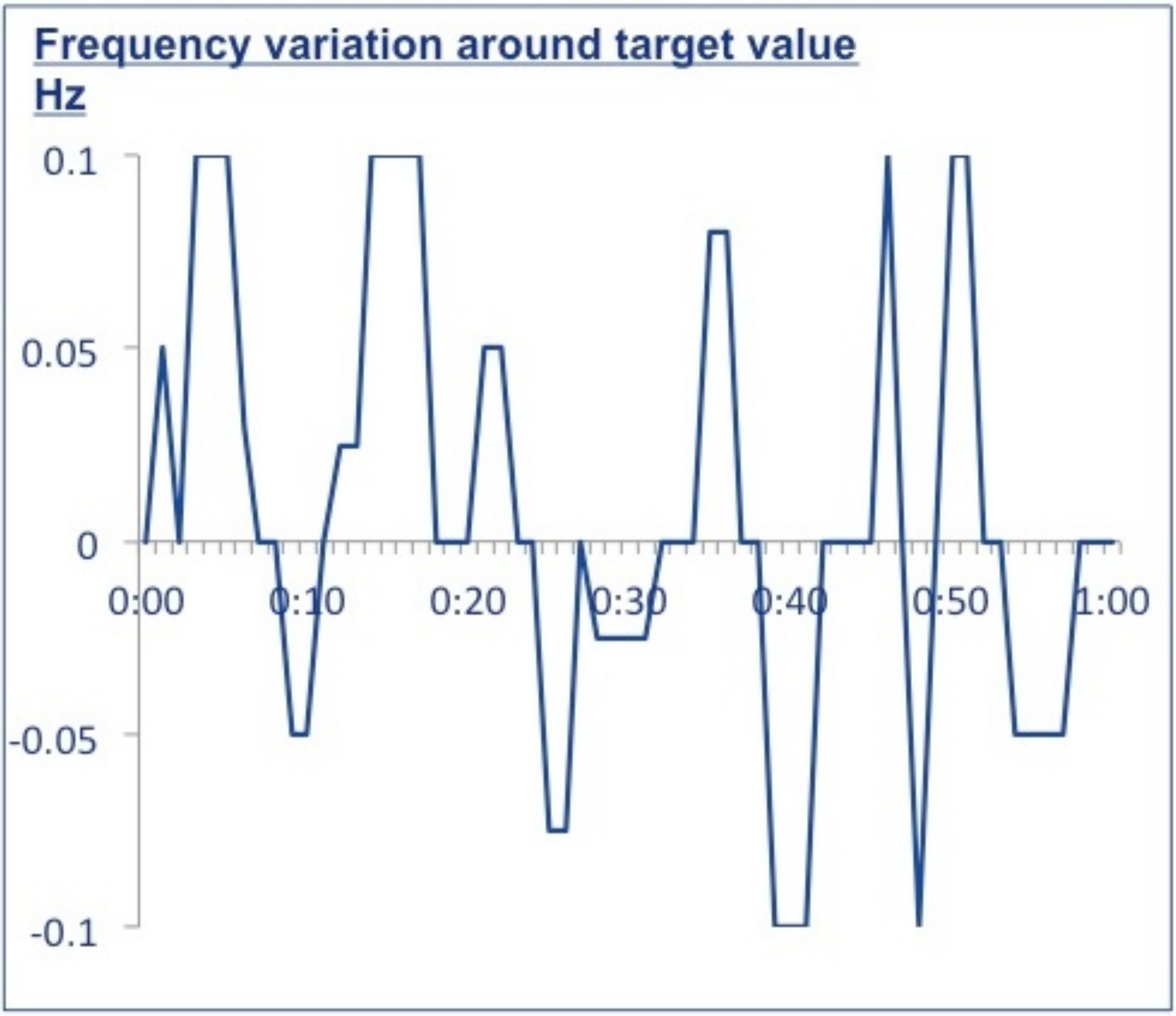

Figure 2: example of frequency variation around the nominal value.

2. Pay for performance and mileage payment

The mileage payment aims to quantify and better compensate the regulation service actually supplied to the grid by a given asset.

Currently, in a European situation, capacity is reserved by the network operator, which can then be activated to supply energy to the grid or consume energy from it. In this scenario, two generators supplying each 1 MW to the primary reserve get the same compensation, whateve their actual activation time (which must be below a minimal requirement in any case).

Is this situation optimal from the grid point of view? A theoretical case tends to show it is not the case. Figures 3 and 4 show two hypothetical ancillary services suppliers. The network operator reserved the same amount of capacity (in MW) for each one of them, and they both supply the same amount of energy (in MWh) to the grid. They accordingly receive the same compensation for their contribution. But what does the grid need? A fast response like the one provided by the asset on figure 3 or a slower one supplied by the asset on figure 4?

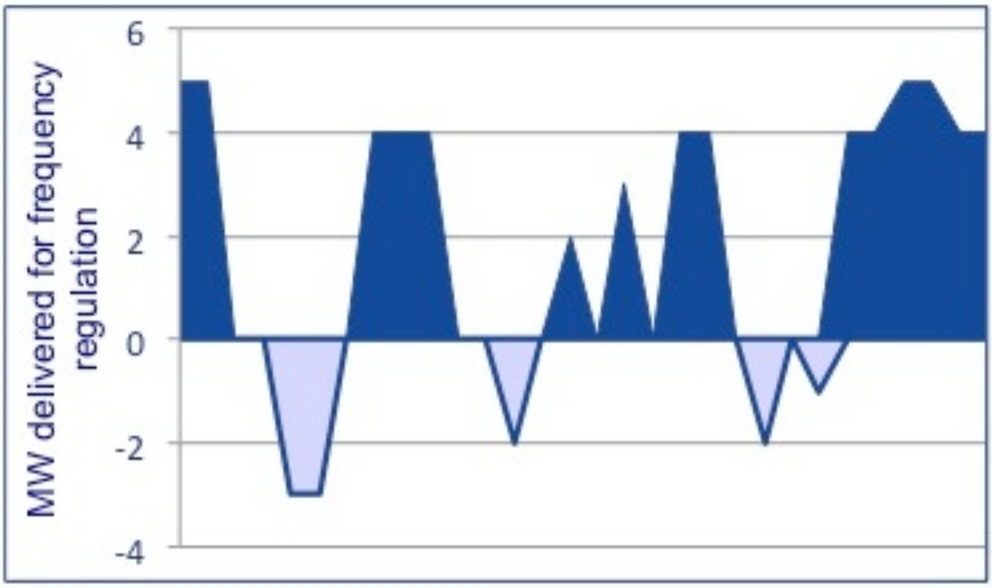

Figure 3: energy supplied by a fast asset for frequency regulation

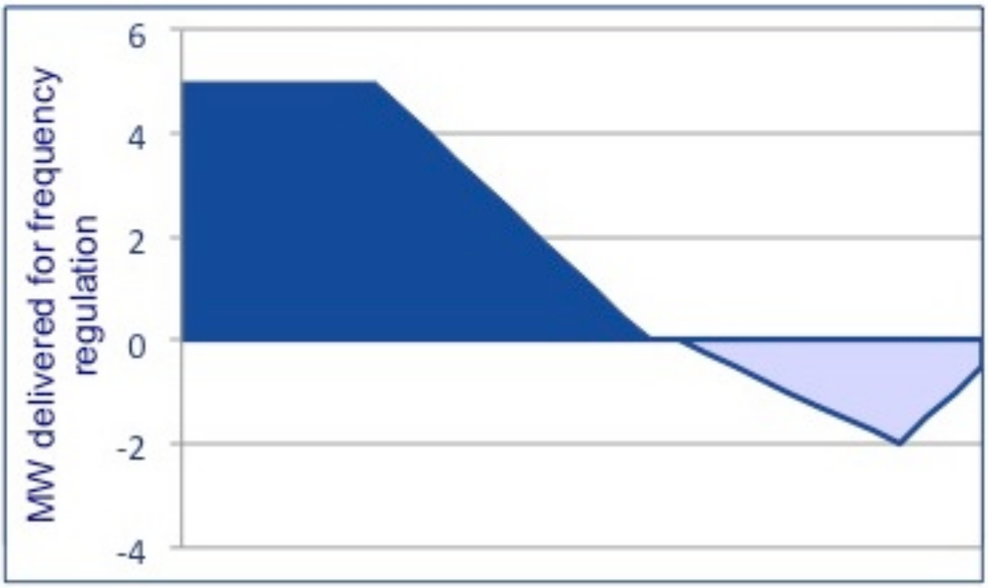

Figure 4: energy supplied by a slow asset for frequency regulation

Frequency variations on the grid are usually fast (see figure 2). Therefore an asset with a figure-3-like response can follow more accurately than the asset shown on figure 4 the correcting signal given by the network operator. It will have a stronger impact on the grid frequency and thus on the grid safety.

Considering this, the US regulator FERC (Federal Energy Regulatory Commission) published order 755 in October 2011, defining the "**pay for performance**" scheme. All ISOs (Independent System Operators) under its jurisdiction must put this scheme in place, which introduces a new way to pay for frequency regulation.

The new type of payment includes the traditional payment per MW reserved to supply regulation. An additional payment is based on the "**mileage**" actually provided by an asset. Figure 5 shows this "MW length", in green. A fast asset such as the one on figures 3 and 5 supplies more mileage to the grid than a figure-4 type asset, and therefore gets paid more.

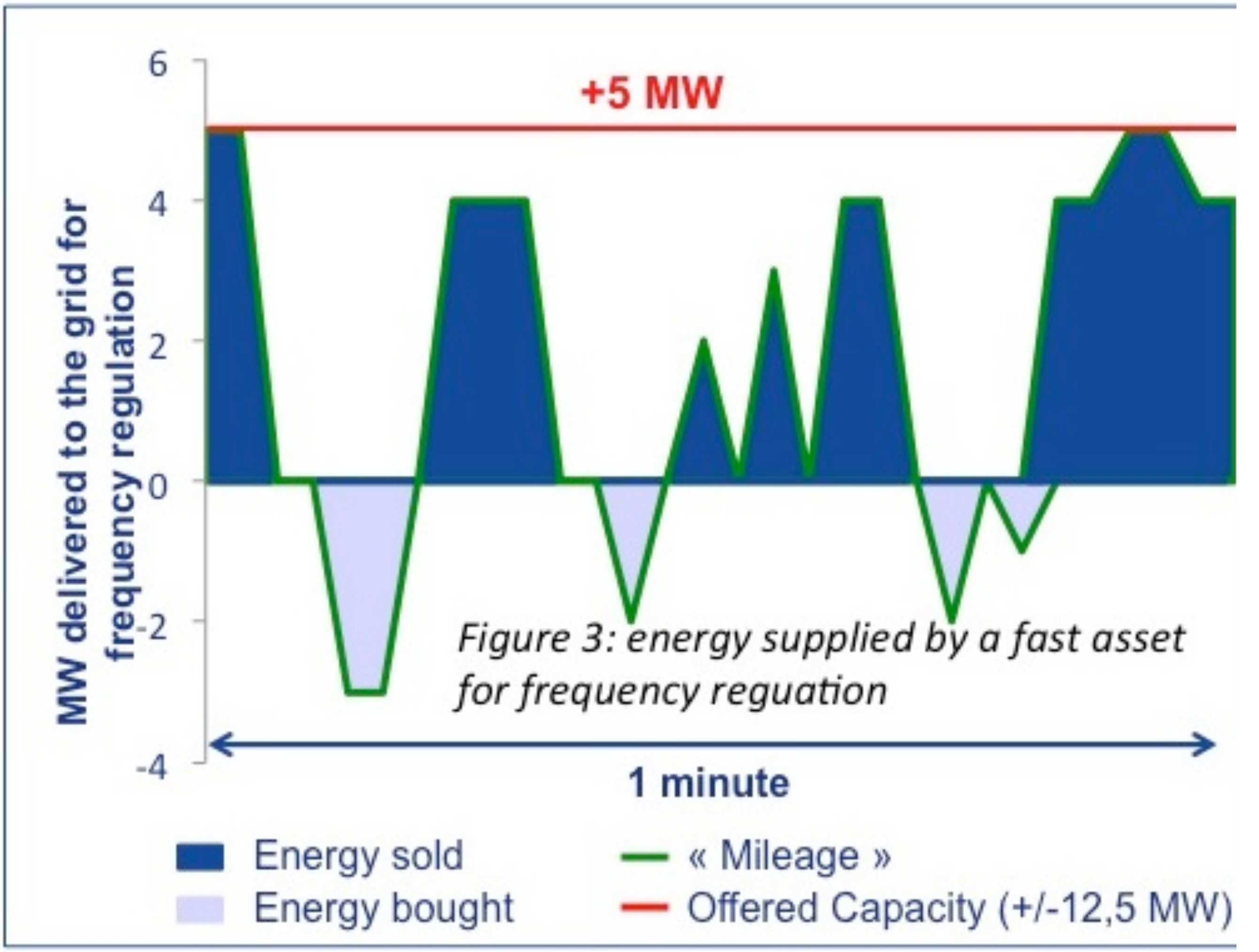

Figure 3: energy supplied by a fast asset for frequency reguation

Figure 5: principle of mileage measurement

The “pay for performance” has been introduced in the largest US ISOs, such as PJM or NYISO.

3. Frequency regulation optimization.

What is the added value to the grid of this improved performance by fast assets?

If only slow assets supply frequency regulation, these assets tend to “overshoot” the frequency regulation correction signal, as shown in figure 6. Therefore there can be too much reserves activated at the same time, in which case reserves in the opposite “direction” need to be activated. This is an additional cost for the system.

Using fast assets will diminish this phenomenon and the total need for reserve will also decrease. The Pacific Northwest National Laboratory estimates that using fast assets for frequency regulation would reduce the total need for reserve by 40% in the CAISO (California ISO)[1].

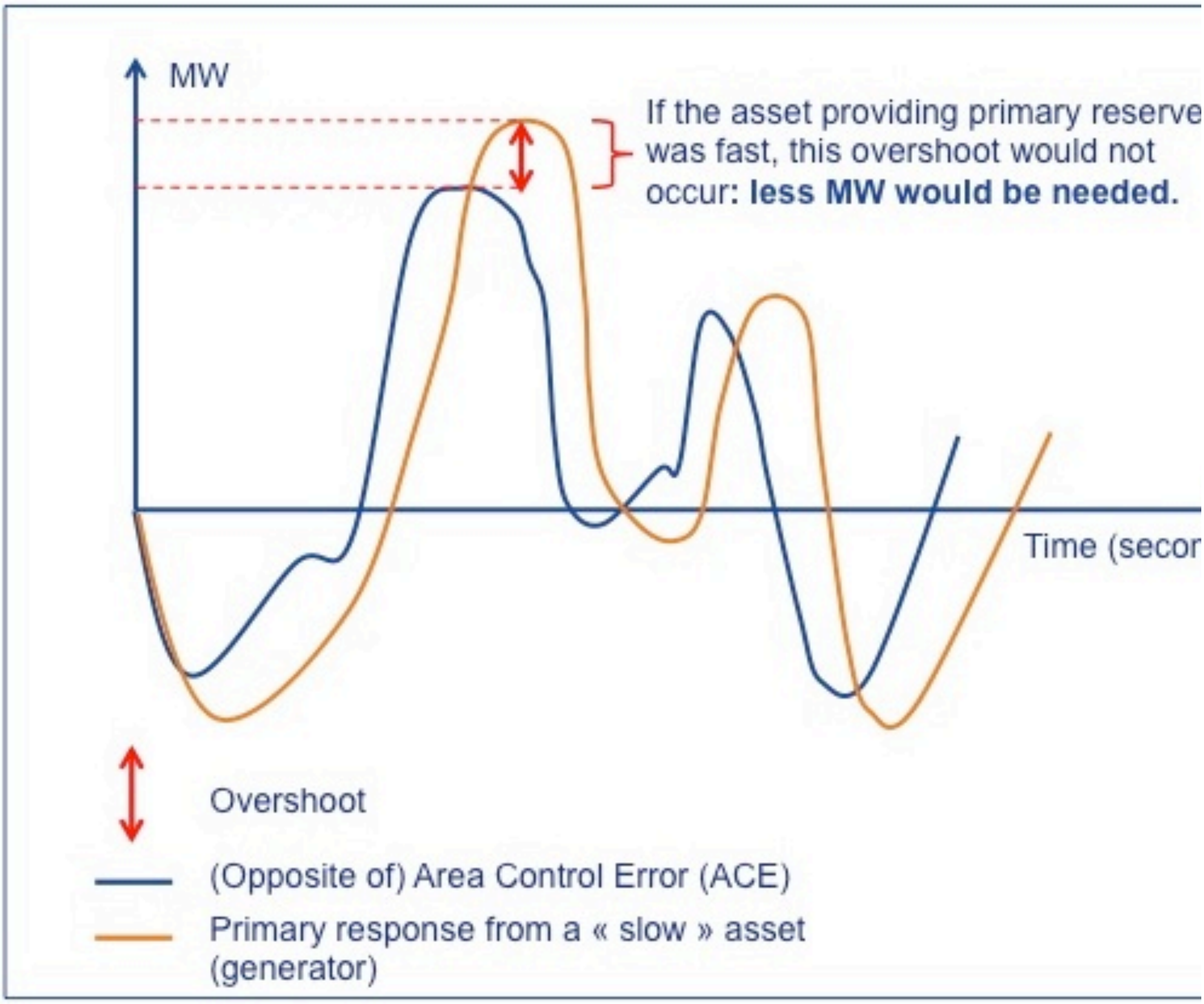

Figure 6: poor quality of response to frequency correction signal by a slow asset

In conclusion, taking fastness of response into account in primary reserve can create a virtuou circle. The superior performance of fast assets such as storage technologies over conventiona thermal power plants enables to secure the grid with less capacity supplying frequency regulation. Furthermore, this can diminish the financing needed to compensates these assets, and thus alleviate the financial burden of frequency regulation on the final consumer.

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[1] Assessing the Value of Regulation based on their Time Response Characteristics, PNNL, June 2008

Economic and social benefits of community energy projects
Source: http://bankwatch.org/sites/default/files/briefing-CommunityEnergy-econsocbenefits.pd

"Community energy projects" refers to energy projects providing for direct benefits to a group of local shareholders. The opportunity for residents to develop and own green energy infrastructure or to jointly leverage untapped energy saving potential, represents a range of economic and social opportunities such as job creation, business opportunities, lowering energy bills and acceptance of sustainable energy production. Community energy projects can take various forms depending on existing legal and financial frameworks, geographies and familiarity with renewable energy and energy efficiency initiatives.

However, some recurring features of Community energy projects are:
• Involvement of citizens in developing and running the project;
• Tangible local social benefits;
• Creation of a cooperative or, more generally, a non-corporate structure;
• Elements of decarbonisation;
• Profits benefiting community members through direct distribution or reinvestment in other community schemes

A significant increase in the proportion of energy derived - or saved - from community energy schemes offers a range of multiple benefits for consumers such as:
• Direct involvement of citizens in energy-related decision-making;
• Mobilisation of community savings, which constitute a new valuable source of funds and a financial incentive to further promote similar schemes;
• Lower energy bills and easier access to green energy;
• Opportunity to pave the way for widespread use of community power projects thanks to tangible success stories that in turn reduce resistance of renewable energy sceptics.

Renewable energy and energy efficiency investments result in reduced dependence on fossil fuels, improved security of supply and greater price stability while reducing greenhouse gas emissions. Energy savings reduce costs for consumers; greater use of renewable energy sources is expected to provide substantial economic benefits. In particular, according to a study conducted in the US1, renewable energy projects can

1 Clean Power Green Jobs, UCS, March 2009

create up to three times the number of jobs per dollar spent versus fossil fuel technologies. Renewables tend to be a more labor-intensive energy source than fossil fuels. A transition toward renewables thus promises job gains. This is even more relevant if we take into consideration the fact that growing automation and industrial consolidation are likely to reduce the number of jobs in traditional energy sectors.
In addition to climate targets and other substantial benefits common to all clean energy solutions, Community Energy projects have several distinct advantages not to be underestimated, as they have the potential to further contribute to economic stability and job creation.

Reduced financing costs: In the early stages, community based renewable energy projects have been able to mobilise development funding to tackle high capital expenditures from numerous sources, including community economic development funding, non-profit grant agencies, environmental organisations, cooperative development initiatives, state and regional incentives etc. Increased availability of risk & return data collected on a local scale, which is one of the hurdles that prevents investors from funding RES projects, will open up the market to private investors. Currently, despite a decline in RES investments in 2012, evidence suggests there is no shortage of potential investment in renewable energy. Rather, there is a shortage of good projects that offer the right combination of risk and return, in particular for institutional investors

2. Profitable community power energy projects will be able to further attract private investments, thus reducing the role of public financing. Local community power project have huge potential, as they contribute to attract long-term investments which might reduce the financing costs of renewable energy.
Creation of green industrial clusters and increased competitiveness: if local community projects reach “critical mass”, we could also envisage industrial clusters where SMEs follow the same model, thus contributing to the expansion of Renewable Energy schemes and increased national energy security and economic stability. In fact, renewable energy is less volatile than fossil fuel prices3
, so that might help create a more
attractive and competitive business environment.
Greater economic benefit: Community energy brings a higher level of economic benefit to local communities than corporate-owned developments. The actual impact will vary with every community and project, but generally the higher the local ownership stake, the greater the economic benefit to the local community.
Increased local awareness and involvement in clean energy: citizens’ participation allows shaping a common approach to develop community power projects. Engaging local stakeholders at a highly personal level (i.e. as equity owners with financial interests) may create increased support for RES projects in specific communities (“Welcome In My BackYard”). As such, community projects provide a mechanism to reduce broader social

2 Nelson, D. and Pierpont, B., The Challenge of Institutional Investment in Renewable Energy, Clin
Initiative, March 2013.

3 Renewable Energy as a Hedge Against Fuel Price Fluctuation, Commission for Environmental Co
barriers to renewable energy. This will allow for an energy-saving model that can easily be replicated across various regions.

Strengthened communities and municipalities: communities will develop expertise in Renewable Energy solutions, form new relationships and be encouraged to shape additional collaborations. Small-scale projects, which are easier to manage as opposed to bigger infrastructures, will result in positive publicity for local municipalities that can "lead by example". This might result in national and international twinning schemes amongst "green municipalities" to exchange views and further contribute to the shift towards renewables.

Better standard of living for local communities: profits can be re-invested within the community or wider region for charitable or socially-oriented investments focusing on inclusion, poverty, general quality of life, strengthening of community relationships, etc. Filling the coffers: by controlling the production cycle of energy within the region, the capital will stay in the area with multiplication effects on public and private finances. Municipalities as well as members of the community will be able to generate savings and will have more disposable funds to invest. This can open doors to community investment funds or even development of community banking in regions, thus increasing local financial independence.