Flexibility Standards for Device & DER Flexibility: Exclusive Interview with Wilco Wijbrandi of TNO

This interview by Matt Chester, Energy Analyst at Chester Energy and Policy, was published in September 2019 on the website [EnergyCentral](#) in the built-up to the Smart Grid Flexibility Conference 2019.

The state of the electric grid is undergoing a massive evolution these days, the likes of which haven't been seen since the legacy utility companies first electrified the world. Smart grid technologies and devices are bringing about more energy data than ever before, distributed energy resources (DERs) are changing where power is produced and who controls that generation, and many stakeholders in the sector are just trying to keep up.

However, it's the forward-looking entities that will dictate how this evolution continues, the organizations that seek to stay ahead of the curve and solve problems before they truly arise in this nascent field. Wilco Wijbrandi, an Energy Management Researcher at TNO, is one such innovator who is looking to prepare the industry for some of the critical needs that many might not even realize are going to be needs. Namely, Wilco is pushing the need for flexibility standards across this new grid. He discussed this topic at the Smart Grid Flexibility 2019 conference.

Q: At the Smart Grid Flexibility conference, you have talked about creating a standardized interface that allows for flexible behavior of devices and DERs on the grid. How did you get interested in this topic and why should other people find it so important?

A: I'm really motivated to help the energy transition happen, and I believe energy flexibility is going to be an important part of it one way or the another. We can't just all switch to driving electric vehicles and electric heating all of a sudden, our power grid was not designed for that. And we can't just all switch to wind and solar power without a proper way to deal with the fluctuation in production. So, we need to have a way to influence local energy production and consumption. Otherwise, we keep depending on conventional power plants. But implementing this in the real world is not an easy task. Some big tech company like Google can't just swoop in with some new technology and solve the problem. Utilization of energy flexibility can only happen if a lot of different types of companies work together. And by having proper standards, we can make sure that there are at least no technical barriers to do so.

Q: Why has such a standardized protocol for energy flexibility equipment not been made commonplace already? What's holding back these efforts?

A: It's all still quite new. There are a lot of good industry initiatives out there, but most of them try to make one specific use case work. There are initiatives that make sure electric vehicles don't charge more than the capacity of the grid connection, there are initiatives that limit solar energy production in case of grid emergencies, there are initiatives to charge batteries with the surplus of solar energy, and so on. Since all these protocols solve slightly different problems, they don't come together into one single integrated protocol. By working at a research institute, we have had the luxury of researching and experimenting with this problem for almost a decade now, together with many different industry parties. We're not just trying to make one thing work well, we're trying to come up with a generic protocol that could work in almost any situation.

Q: What has been the reaction of the industry as you make strides in these efforts? Are utilities and grid operators generally excited and optimistic, or is there a sense of skepticism about whether these goals are achievable?

A: Many energy suppliers and aggregators we talk with can't wait with using aggregated energy flexibility on their trading floor but have trouble with finding a cost-effective way of controlling flexible devices. That is mainly because of two reasons. They basically want

to utilize energy flexibility from any source, but they need to implement a different protocol for almost each type of device they encounter, which requires a lot of extra implementation effort. Secondly, the costs of connecting these devices are quite high. Typically, an extra piece of hardware with an Internet connection needs to be connected to the device, some custom software needs to be developed and someone needs to service it when there is something wrong. This might not be a significant problem for larger DERs, but for smaller domestic devices, such as electric heating and batteries, this is simply just too expensive. And that's a waste, because together all these devices have a huge flexibility potential. So, the only way to make it work is to make sure manufacturers implement proper energy flexibility standards in their devices and make sure that it works easy and reliably.

DSOs are typically very aware that energy flexibility might be a crucial technology to support their operation during the energy transition, but due to the energy market separation in a lot of countries, they are not allowed to control devices directly. They recognize these challenges and are therefore experimenting in pilots with flexibility and related potential standards and solutions. That is why, for example, Enexis, TNO, and eMobility foundation ElaadNL engaged in the Interflex project on local use of flexibility for an increasing share of renewables on the distribution grid. This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement number 731289.

Several companies active in the energy sector that share our vision are working together in the FlexiblePower Alliance Network to further develop and promote our protocol.

Q: One of the keys to your approach to this solution is to remain device and application agnostic and not make any assumptions about how or why it's being optimized. Can you talk about why this is unique and what benefits it would bring in implementation? Are there any downsides?

A: There are many ways you could provide incentives to consumers to provide energy flexibility. I don't believe every country will implement the same incentives, and I don't believe these systems will stay the same while we go through the energy transition. Imagine you live in a house with solar panels on the roof, and you decide to buy a battery for your home. You are probably planning on using this battery for a good 20 or more years. Maybe, at the place where you live, there is a feed-in tariff. When you sell energy to the power grid, you don't get as much money as when you buy it. So, you can save money by charging your battery with the surplus of solar energy and using that

energy when the sun is not shining. But when adoption of renewable energy increases, and there is more fluctuation in energy production, the legislation at the place where you live might switch to hourly tariffs. Now all of a sudden, it makes financial and environmental sense to charge the battery when energy is cheap, and discharge when it is expensive. And when technology evolves, and there are more and more capacity problems in your local power grid, an aggregator, who can trade the aggregated flexibility on energy markets and with your DSO, makes you an offer to control your battery in exchange for a fixed fee. Or maybe you decide to go off the grid and use the battery to help balance the power of your building or your local energy community. So, the way we use flexible devices might very well change during the lifetime of the device. We can't expect any manufacturer to keep developing firmware updates for each and every device they produced in the last 20 years. Having a stable standardized protocol that can work with any optimization goal means that all we need to do is connect the device to a piece of energy management software, which could be developed by anyone.

The risk of having an all-purpose solution is always that you either make it too complex, or that you make it too generic and that you make simplifications that don't work for a specific use case. We chose a pragmatic approach here and tried to keep things rather simple. That means that for some use cases, we might not be able to squeeze the last drop of flexibility out of the device. But if that allows you to utilize the flexibility of the device in a cost-effective manner, that might not be a such a bad tradeoff.

Q: Beyond your pet topic of flexibility standards, what are other issues and technologies that we need te keep in mind?

A: Well, obviously, a standard is just one part of the puzzle. For efficient utilization of energy flexibility, much more needs to happen. In order to have a business case for it, we need to have energy markets which can incorporate energy flexibility (which might require new policies and legislation), we need to have integration with DSO systems if we want to utilize it for LV congestion management, we need clever algorithms to make sure it is reliable and we need cost-effective ways of connecting and managing all these devices.

*Wilt u meer weten over energieflexibiliteit? Lees dan ook eens de kennisdossiers van TKI Urban Energy over '*Het ontsluiten van flexibiliteit in de gebouwde omgeving*' en '*waarde van flexibiliteit*'.*