PROSUMER POLICY ADVISORY PAPER

The Netherlands

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Executive summary

In view of the recent “European Green Deal” citizens and cooperatives are expected to play an increased role in the take-up of renewables through self-consumption. For consumers it should be easier to play a more active role and engage as prosumers in electricity markets, by investing in renewable energy, most obviously photovoltaics (PV), and then consume, store or sell the energy they produce, and benefit from functioning and organized electricity markets.

The state of play in the Netherlands is that net metering will be abolished in a gradual manner from 2023 to 2031, while assuring that present and future PV investors in residential PV systems can count on an economic payback time of about seven years. This assumes self-consumption of 30% of the annually generated amount of PV energy. The market growth in PV capacity in the Netherlands has been fast in recent years leading to about one million prosumers already. It is predicted that this will more than double by 2030.

Incentives should be developed to make better use of the existing grid structure in order to better manage net reinforcement. Congestion management and the use of flexibility options, such as available by using batteries, electric vehicles (EVs) and demand-side management will be necessary. This requires smart grid technologies and communication protocols, which much be developed in the EU in collaboration with national standardization bodies. Any technical solution should be smart-grid ready, allowing for energy management in a smart and efficient manner.

Means to increase profitability of PV and self-consumption should be made possible and regulatory barriers for exchanging and/or trading surplus energy as well as double taxation should be removed. Any measure that may lead to changes in the electricity bill for prosumers should be clear and transparent, and ideally leading to a simplified bill. At the same time, this should not lead to additional administrative burden on retailers.

1. Overview of PV Prosumption and its estimated growth potential in the Netherlands

A "prosumer" refers to an electricity consumer that besides consuming electricity also is producing electricity in support of his/her own consumption. The word is constructed based on the association of "producer" and "consumer". The EU Renewable Energy Directive[1] uses the following definition:

> *"a 'renewable self-consumer' means an active customer or a group of customers acting together as defined in this Directive who consume and may store and sell renewable electricity which is generated within their premises, including a multi-apartment block, residential area, a commercial, industrial or shared services site or in the same closed distribution system, provided that, for non-household renewable self-consumers, those activities do not constitute their primary commercial or professional activity."*

PV Prosumer (PVP) Concepts are holistic descriptions of specific use cases of the PV technology. They are based on business models for PV prosumers and may involve other technology such as batteries or vehicle-to-grid (V2G) options. PVP concepts can be classified according to their system boundaries resulting in the distinction of on-site, local, district, regional and trans-regional PV usage models as illustrated in Figure 1. This figure also shows possible interfaces between the private and the public grid. In the Netherlands all three PVP concepts are possible, i.e. single use, collective use within buildings, and collective use in a community.

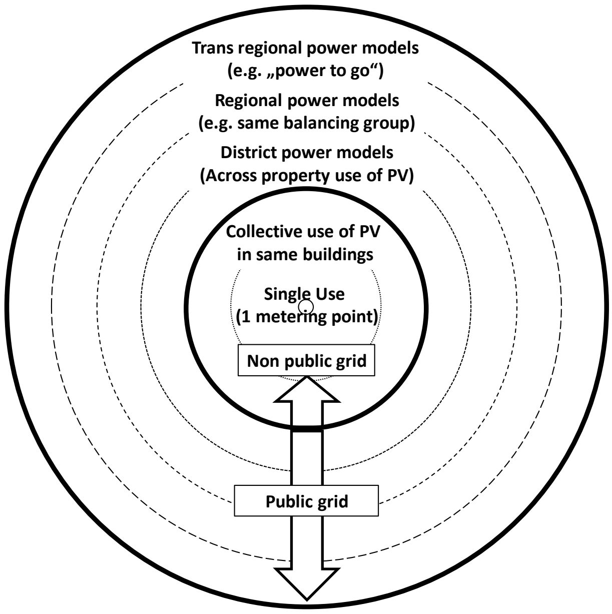

Figure 1. System boundaries of on-site, local, district, regional and trans-regional PV power usage.

[1] European Commission: DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources (recast), COM (2016) 767 final, 2016/0382 (COD), Brussels, 30.11.2016

Individual self-consumption

Individual self-consumption or single direct use is allowed in the Netherlands, and has been in fact standard practice for a long time. This leads to a net annual electricity consumption for a household with a PV system which is lower compared to the same household without a PV system. This principle is known as net-metering (or in Dutch “saldering"): the price for buying retail electricity (~0.23 €/kWh) is the same as the received benefit from the utility when feeding electricity back to the grid. With present market prices of 1-1.5 €/Wp for a 3-5 kWp PV system, economic payback time is 5-7 years. A revision of the net-metering system is in progress, leading to a gradual abolishment from 2023 until 2031. Given the present market developments, it is estimated that the number of prosumers in the Netherlands will continue to increase up to 2.5 million in 2030, as indicated in Figure 2. This estimate is based on projections from the Netherlands Environmental Assessment Agency PBL[2], for a typical PV system size of 3.5 kWp, and a 25% contribution of residential PV capacity to the national capacity prediction. With typical household demand of 3000-3500 kWh annually, household self-consumption presently is estimated to be about 30% on an annual basis[2].

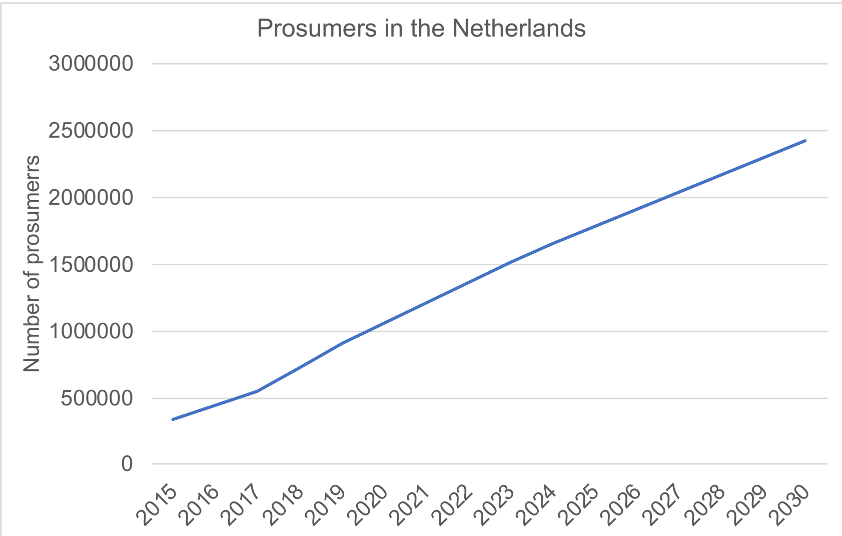

Figure 2. Estimated number of prosumers in the Netherlands.

Collective self-consumption

In apartment buildings in which apartments are owned by individuals, PV energy can be used for collective services in the building such as elevators and lighting; in general, this solution is not considered collective self-consumption, as the consumer is only one entity, namely an association of apartment owners (VvE: Vereniging van Eigenaren). Another possibility is that individual apartment owners own part of the full PV installation on the roof, and are directly connected to the apartment, while this strictly speaking is not collective self-consumption. A combination of both

[2] PBL, Klimaat en Energieverkenning 2019, https://www.pbl.nl/sites/default/files/downloads/pbl-2019-klimaat-en-energieverkenning-2019-3508.pdf

options is possible using additional hardware as distributors[3]. Finally, the Postal Code Rose policy can be applied, in which anyone living in one postal code is able to invest in a PV system within and directly around the postal code area he/she is living in. The benefit is a waiver for energy tax on the energy bill. This can be regarded as constituting an energy community.

2. Impact on electricity distribution networks and strategies to manage the PV increase in the Netherlands

With the predicted increase in number of prosumers and associated PV capacity, and when no additional measures are taken to increase self-consumption, excess PV energy will have to be transported within the local distribution grid, as well as into the medium and even high voltage grids. This may lead to congestion at several locations in the grid, overloading grid assets such as transformers and perhaps feeders/cables. Even more so, when electrification of transport, i.e., electrical vehicles continues at the present pace, in combination with expected electrification of heating systems in buildings due to the phase-out of gas-based heating systems, residential loads will increase concurrently. Today's grids have not been designed for that, and measures need to be taken. As a typical example, Figure 3 shows a simulation result of the impact on the electricity grid of a small community with or without 100 kWp installed PV for two scenarios: a 'Baseline' scenario with natural gas heating and no EVs, and a 'Future' all-electric scenario with electric heating and EVs[4]. The load duration curve shows that the residential load increases considerably when electrifying heating and transport,

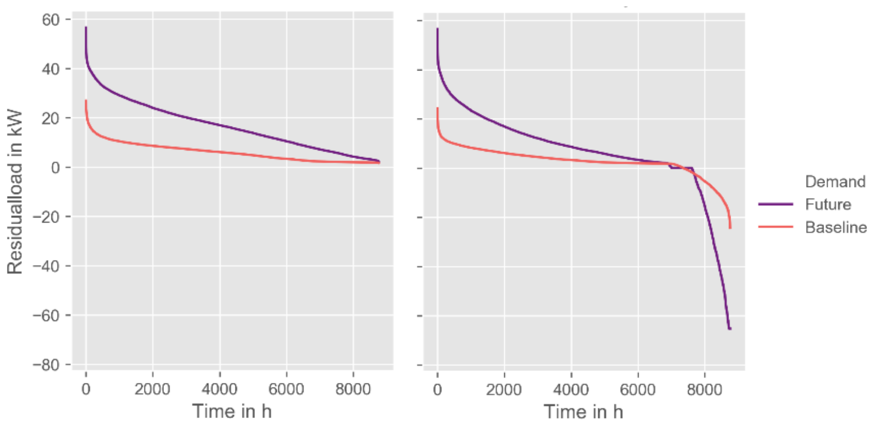

Figure 3. Load duration curves of energy communities for baseline and future scenarios, without PV (left) and with PV (right)[4].

[3] For example, "Herman" the power distributor (named after Hermann Scheer, http://lens-energie.nl/herman-de-zonnestroomverdeler/)

[4] I. Lampropoulos, W. Schram, W. van Sark, Impacts of PVP concepts on grid system – the Netherlands, Concept and guidelines, https://www.pvp4grid.eu/wp-content/uploads/2020/03/PVP4Grid_D4.2_NL.pdf

and that load can be negative, which corresponds to excess PV energy. Measures to lower the peaks, e.g., by increasing self-consumption, are necessary. These all revolve around being able to adequately manage power and energy flows at all levels of the electricity grid. On a low-voltage distribution grid level as managed by the Distribution System Operators (DSOs) this can be done by using storage, either on a household or district level, by demand side management programmes and by employing V2G options that can assist distribution grid operators in congestion management.

New legal entities such as aggregators and/or charge point operators can devise new business models that incentivize households and EV owners to adapt behavior in support of grid management. These entities will also need to be able to use existing and new market platforms for energy trading. Flexibility is the common denominator. In recent years, the Dutch Transmission System Operator (TSO) TenneT has updated so-called ancillary services product specifications for balancing, while also processes have been streamlined, e.g. allowing shorter bid periods. This enables a broader range of flexible assets to play a role in this market. Furthermore, TenneT has initiated pilot projects for system balancing (i.e. for keeping the 50 Hz frequency between certain boundaries), and particularly for the provision of Frequency Containment Reserves (FCR), and Frequency Restoration Reserves (FRR), by using aggregated assets, which can be decentralized energy assets.

Regarding congestion management, a coherent approach by TSO and DSOs is important to manage congestion and to enable access to flexibility for that use where it is most valuable, and the GOPACS[5] (Grid Operator Platform for Congestion Solutions) project was initiated in early 2019 in cooperation with grid operators and the Energy Trading Platform Amsterdam (ETPA). Based on up-to-date information, the grid operators determine where and when congestion can be expected. To solve congestion at a certain part of the grid, electricity production/consumption needs to be adjusted. The congestion situation is entered into GOPACS, and market parties with a connection in the affected area can then place an order on the platform. However, the balance in the electricity grid at a national level is not to be disturbed. This is why an adjustment in the congestion area is combined with an opposite order from a market party outside of the congestion area.

[5] Dutch grid operators launch GOPACS: a smart solution to reduce congestion in the electricity grid, Jan. 29, 2019. Available online: https://www.tennet.eu/news/detail/dutch-grid-operators-launch-gopacs-a-smart-solution-to-reduce-congestion-in-the-electricity-grid/

3. Recent and ongoing revision of the PV regulatory framework in the Netherlands

The revision of the framework for PV prosumption in the Netherlands is related foremost to the abolishment of net metering scheme, which will start in January 2023. The annual reduction has been proposed recently by the Ministry of Economic Affairs and Climate[6] to be 9%/year between 2023 and 2030. In 2030, the last 28% will be reduced to 0% in 2031. This should ensure a slower increase in economic payback time than using the earlier suggested 11%/year. If net metering would not be abolished then the economic payback time would reduce from ~7% today to ~4% in 2031, based on the calculations shown in Figure 4. The calculations are performed for a reference PV system consisting of 10 PV modules of 300 Wp and assuming a self-consumption rate of 30%. A sensitivity analysis has been done by TNO[7], showing that economic payback time increase or decrease by about one year only. Also, the minimum feed-in remuneration for the amount of energy that cannot be netted has been set at at least 80% of the retail electricity price excluding all taxes, or about 0.06 €/kWh. The Electricity Act is expected to be modified according to the above proposal, if parliament supports this.

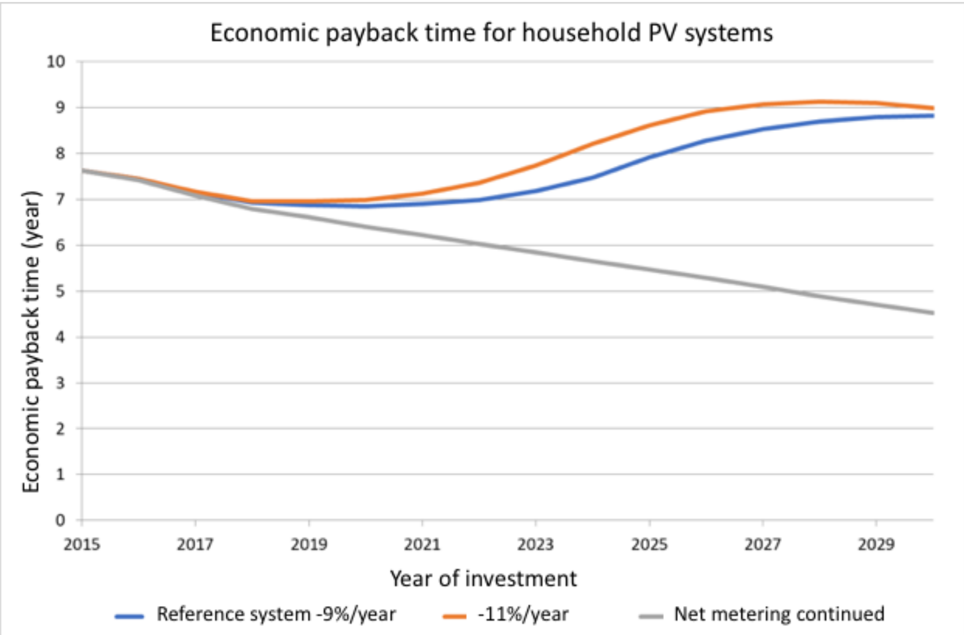

Figure 4. Economic payback time for a reference PV system for 9% and 11% reduction per year, compared to continuation of net metering.

[6] Letter to parliament on net metering abolishment https://www.rijksoverheid.nl/documenten/kamerstukken/2020/03/30/kamerbrief-over-afbouw-salderingsregeling

[7] TNO (Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek), https://www.rijksoverheid.nl/documenten/rapporten/2020/03/25/bijlage-effect-afbouw-salderingsregeling-op-de-terugverdientijd-van-investeringen-in-zonnepanelen

The proposed phasing-out of the net metering scheme has no effect on the exemption from tax on the electricity generated behind the meter itself and consumed immediately. For this, a small consumer still pays no energy tax (EB) and renewable energy fee (ODE). Direct self-consumption of the generated PV energy is therefore still the most profitable option. However, an increase in self-consumption will lead to a reduction in economic payback time. In the extreme case of increasing self-consumption from 30% to 100%, the economic payback time will be reduced by about six months only using the TNO calculation model[7], using otherwise identical assumptions as for the reference case.

The grid operators' initiatives described above such as GOPACS will open up opportunities for prosumers and aggregators to participate actively in ancillary services markets.

Finally, to phase out the net metering scheme, it is mandatory that all small consumers have a metering device (smart meter) that can measure the amount of energy taken from the grid as well as the amount of energy fed back into the grid.

4. Barriers and recommendations

The recently adopted "Clean Energy for All Europeans" Package[8] is aiming to further develop one of the EU's major long-term policy initiatives, namely the EU Energy Union[9]. This new framework should enable citizens to actively participate on a level playing field across the market and to benefit from Europe's energy transition. It aims at empowering and protecting consumers through better information on energy consumption and costs and helps issuing a tighter safety net to addresses energy poverty and vulnerable consumers. For consumers it should be easier to play a more active role and engage as prosumers in electricity markets, by investing in renewable energy generation, most obviously PV energy, and then consume, store or sell the energy they produce, and benefit from functioning and organized electricity markets. The recent "European Green Deal" will need citizens and cooperatives to play an increased role in the take-up of renewables through self-consumption. Any new provisions should aim at tackling barriers related to over-burdensome bureaucracy by preventing consumers from being subject to disproportionate technical and administrative requirements and procedures.

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[8] Clean energy for all Europeans package, https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans

[9] Energy Strategy, https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union

4.1 Barriers

Barriers for increasing PV systems roll out in residential areas are not related to the proposed scheme detailed above, as the current and expected economic payback time of some 7 years is within a range of 5 – 8 years which has been found to be a good economic incentive for house owners willing to invest in PV[7]. However, as the present energy bill already is difficult to be understood for pro/consumers, any measure such as the reduction of net metering fee should be included in the bill in a clear and transparent way. Additional administrative burden on retailers should not be too high as well. Both may form a barrier.

While the economic payback time is estimated to remain at about 7 years, this is based on various assumptions on PV cost reductions and electricity price increases. It these assumptions turn out not to be correct, they should lead not to an increase in economic payback time. Presently, this is not guaranteed.

Barriers for increasing self-consumption can mostly be categorized as regulatory rather than technical. Increasing self-consumption is not economically interesting with the presently proposed scheme. Technically, self-consumption can be increased by using batteries and demand-side management. Batteries are rather expensive, but considerable price reductions are expected. Demand-side management solutions such as operating your washing machine when the sun is shining may be hampered by reluctance to behavioural change. However, the (gradual) abolishment of the net metering scheme is expected to promote the development of such technologies.

Barriers also exist on self-consumption for apartments within one apartment building. Often, homeowners in multi-family dwellings are united in an Association of Owners (“Vereniging van Eigenaren”) that must agree on making investment decisions. Currently, self-consumption is calculated at the single home level. When multiple homes share one roof, determining self-consumption on single home level makes co-investing in rooftop PV more complicated and less attractive, whereas when PV electricity is used within the building, it does not lead to grid stress.

Other means to increasing profitability of PV and self-consumption such as exchanging and/or trading surplus energy are not allowed and are further hampered by double taxation. Firstly, taxing feed-in of energy to the grid, and secondly importing it from the grid by another (even neighbouring) household.

4.2 Recommendations

Any measure that may lead to changes in the electricity bill should be clear and transparent, and ideally lead to a simplified bill. At the same time, this should not lead to additional administrative burden on retailers.

The cheapest option to increase self-consumption is to removing legal restrictions, thus allowing prosumers to trade with neighbours, without double taxation. For apartment buildings efforts are required to change the scope on self-consumption calculations from the single home level to the building level, while considering the administrative burden on retailers. Storage and EVs (in demand-side management solutions) can be used, and both will be decreasing in terms of cost in the coming years. Also, behavioural change and communication about self-consumption are good options, and cheap. These should provide better insights also about the rationale for self-consumption in light of the energy transition challenge. Policies need to be designed that should encourage trade between (neighbouring) prosumers in a community as defined by the area that a transformer is serving. These may include differentiated grid tariffs as well, as long as this does not lead to more complex bills and administrative burdens.

Any technical solution should be smart grid ready, as in future local grids, smart energy management is necessary, and present and future technologies such as Internet of Things (IoT) should be ready for that. Many PV inverters already have options for external control, but heat pumps typically do not. This should be arranged by legal means. Subsidy schemes should be designed that require technologies to be smart grid ready, otherwise they do not qualify.

Incentives should be developed to make better use of the existing grid structure while postponing net reinforcement, such as congestion management (e.g., the GOPACS initiative) and the use of flexibility options in batteries, EVs and other demand-side management resources. This requires smart grid ready technologies and communication protocols. While in the US and Asia standards on integration of smart grid technologies, and especially on communication protocols between these technologies, are being developed, this is hardly the case in the EU, and should be developed in collaboration with national/EU standardization bodies.