



# Trends and policy options for SSRE development

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# OVERVIEW

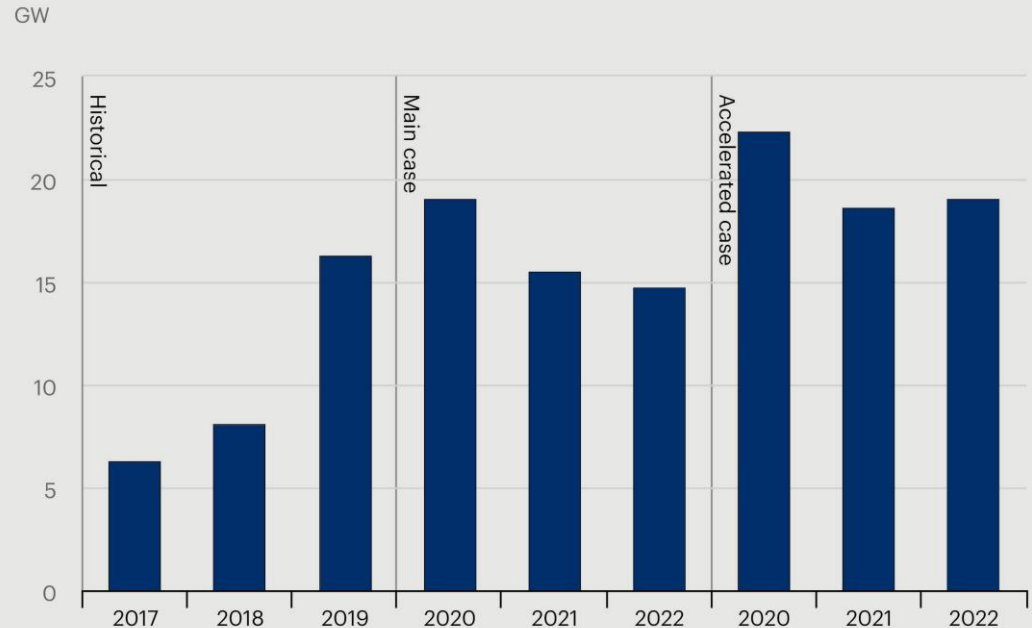
- Solar PV will dominate global RE investment through the decade, accounting for 88.2% of the funding. Of this, residential solar PV may account for 49.3% of the total investments, and commercial and industrial solar PV for 38.9%.
- By 2030, Asia will account for about 48% of PV total investment, followed by North America (est. 17.5% share) and Europe (est. 16%). Total distributed generation (DG) installed capacity is projected to reach 1182.00 GW by 2030, accounting for 10% of global installed generation in the year.
- Many new solar PV customers will opt for a solar + storage system as standard. Existing customers will tend to add storage systems to existing solar PV units. BNEF projects a 47% drop in storage capex cost by 2030.
- RE promotional programs continue to evolve.

Source: The release of the report "Growth Opportunities in Distributed Energy, Forecast to 2030". May 2020 ID: 5894509 Frost & Sullivan. Summary. Reportlinker.com.  
[https://www.reportlinker.com/p05894509/?utm\\_source=GNW](https://www.reportlinker.com/p05894509/?utm_source=GNW)

# SSRE GLOBAL DEVELOPMENT OVERVIEW

- Global PV expansion after 2022 is expected to accelerate due to continuous policy support, storage and cost reductions.
- The distributed PV segment resumes growth during 2023-25 as economies recover.
- Popularity of residential PV installations is booming thanks to continuous government support schemes.

**Global Solar PV residential net capacity additions, 2017-2022**

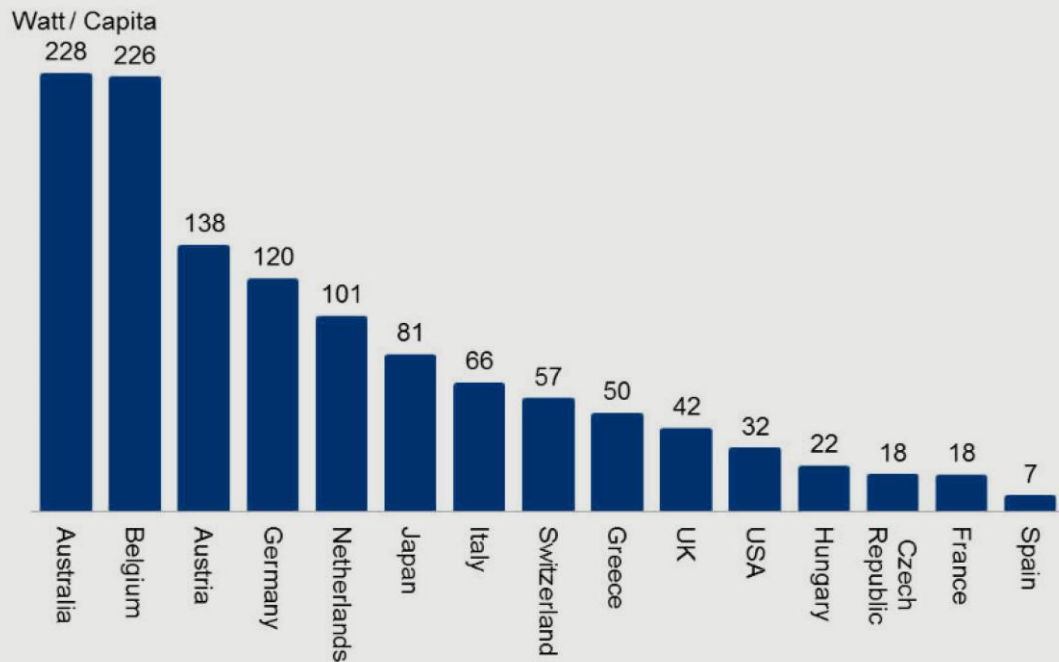


Source: IEA. Renewables 2020 report – Solar PV

# BUSINESS MODELS

- China Pilots “Electricity Prosumer”
- Business model for new services
- Residential solar and storage business
- Typical financial model of Small-scale renewable
- Comparison of Small-scale PV compensation mechanisms

**Residential capacity per capita in Europe’s largest residential markets, plus the U.S., Australia and Japan**

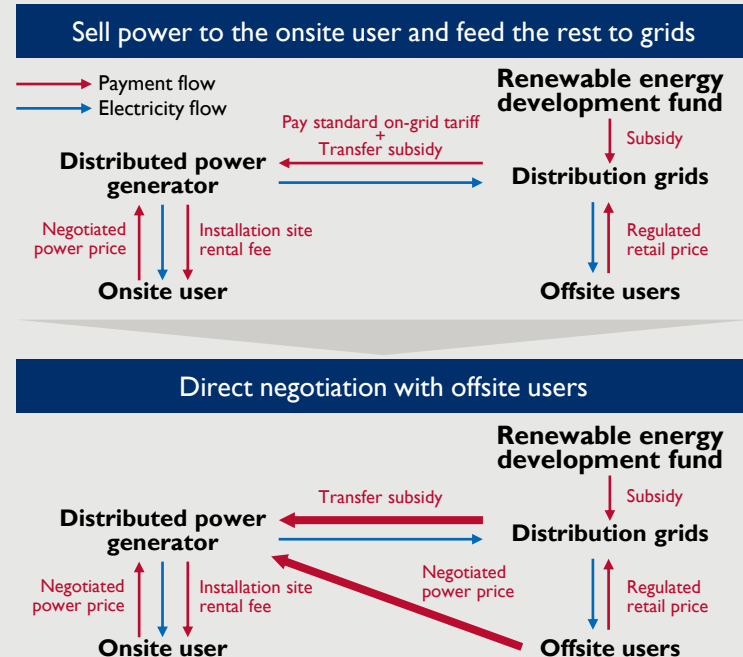


Source: Bloomberg New Energy Finance

# BUSINESS MODEL. CHINA PILOTS “ELECTRICITY PROSUMER”

- Chinese regulators published new guidelines allowing distribution-grid-connected (DGC) capacity to sell generation directly to neighboring power users.
- Before this, DGC generation capacity had two options: sell power to the grid or sell to an onsite (host) user.
- Direct power purchase: sellers negotiate price and volume with buyers and pay the regulated distribution tariff to grid companies, which will be determined by local governments.
- Consignment sales: sellers consign power sales to grid companies, which pay sellers an average retail price with deduction of regulated distribution tariff and line loss.
- This allows piloting of the so-called “prosumer” business model, with end users generating power for themselves while also supplying others.

## Changing business model for distributed power generation



Source: BNEF. Note: Illustration assumes distributed power generation asset is developed by third-party investor and provide onsite consumption, although in reality the onsite user may own the asset, and all generation may be sold to offsite users or fed to grids.

# BUSINESS MODEL. BUSINESS MODEL FOR NEW SERVICES

## Connected home

Originally, utilities' connected home offering centered around smart thermostats, often provided by a 3<sup>rd</sup> party. Today a growing number of connected home platforms are built in-house, as a hub for “modular” service products (demand response energy management, Storage, FIT, EV charger, etc.)

## Residential solar and storage

Rooftop solar is offered to customers for upfront purchase, often with a 3<sup>rd</sup> party developer who installs or maintains.

Some utilities provide behind-the-meter storage. Some offerings aim to improve distribution network operations

## Home EV charge points

Many EU utilities offer home charge points for direct purchase from the websites, with a dual goal of encouraging EV adoption and boosting consumption.

## Peer-to-Peer trading

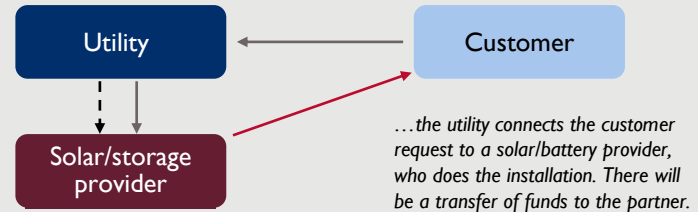
Peer-to-peer (P2P) trading enables customers to buy and sell electricity directly to other customers. Some platforms make it easier for end-users to find counterparties today.

# BUSINESS MODEL. RESIDENTIAL SOLAR AND STORAGE BUSINESS

- **Direct purchase:** most EU utilities require customers to purchase behind-the-meter systems up-front through a single payment. Often, installation is sub-contracted to a 3<sup>rd</sup> party. Utilities with in-house O&M teams may offer maintenance contracts to end-users to earn additional revenue.
- **Loan:** Instead of requiring customers to purchase system upfront, utilities allow customers to buy through monthly instalments.
- **Purchase with PPA:** Some utilities require customers to sign a PPA, naming the utility as their energy provider, to obtain a behind-the-meter system.
- **Virtual power plant:** The utility can “rent” part of the system's capacity from the customer, usually for a monthly fee. This allows it to operate multiple systems as an aggregated plant and gain revenues from generation and ancillary services,
- **Rooftop leasing:** This involves the utility owning the system while leasing a site (often roof space) from the customer.

## Sample direct purchase with third-party provider

The customer goes through the utility for a solar panel/battery, and pays for it directly....

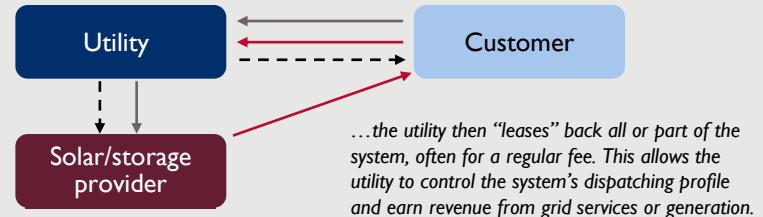


...the utility connects the customer request to a solar/battery provider, who does the installation. There will be a transfer of funds to the partner.

In some cases, the utility will provide the maintenance service to the end-user, while in others cases this will be done by the partner.

## Sample virtual power plant model

The customer receives the behind-the-meter system from the utility, or from a partner that provides the system...



...the utility then “leases” back all or part of the system, often for a regular fee. This allows the utility to control the system's dispatching profile and earn revenue from grid services or generation.

Source: Bloomberg New Energy Finance

—→ Services rendered    —→ Upfront payments    - - - → Recurrent payments

# BUSINESS MODEL.TYPICAL FINANCIAL MODELS OF SMALL-SCALE RENEWABLE

## Financial models for small-scale renewables

- **Debt financing** offers a strong economic case for commercial solar customers. Debt is simple but inflexible since the majority rent their premises.
- **On-site PPAs** is a popular long term financing option. PPAs can be transferred between site tenants. They do not impact user balance sheet, but they may cost more than other options due their complexity.
- **Leasing:** Leased solar systems are expected to decline. Leases and PPAs are priced and structured similarly, but leases are carried on balance sheet.
- **EAAS** – a 3<sup>rd</sup> party provides multiple energy services to a business for a fee. An EAAS provider may add solar, storage, EE equipment or demand response capacity to a site. Company is paid based on power bill reductions.

## Characteristics of various solar financial products

	SALE SIMPLICITY	ECONOMICS	RENTER SUITABLE	BALANCE SHEET
Upfront	strong	strong	weak	average
Debt	strong	strong	weak	weak
PPA	average	average	strong	strong
Lease	average	weak	average	weak
Energy-as-a-service (EAAS)	average	weak	weak	strong

Source: Bloomberg New Energy Finance



# BUSINESS MODELS. COMPARISON OF SMALL-SCALE PV COMPENSATION MECHANISMS

	IS OFFTAKER CONTACTED	VALUE OF SELF-CONSUMPTION	VALUE OF GRID INJECTIONS	VALUE OF INJECTIONS ABOVE TOTAL DEMAND	LEADING EXAMPLES
<b>Gross FiT</b>	Yes	FIT rate (sometimes retail tariff in addition)	FIT rate	FIT rate	Germany, China France
<b>Net FiT</b>	Yes	Retail tariff	FIT rate	FIT rate	Australia*, Japan (<10kW)
<b>Net energy metering</b>	Sometimes	Retail tariff	Retail tariff	Varies( typically much lower than the retail tariff)	USA (most), India Netherlands
<b>Premiums or adders</b>	Sometimes	Retail tariff + “adder”	Varies + “adder”	Varies + “adder”	Italy, China
<b>Renewable energy certificates</b>	No	Retail tariff + REC	Varies + REC	Varies + REC	Belgium, South Korea
<b>Export tariff</b>	No	Retail tariff	Varies (typically less than the retail tariff)	Varies (typically much lower than the retail tariff)	Australia(most) Italy

Source: Bloomberg New Energy Finance. Note: Asterisk indicates schemes no longer in place. Exceptions to the above arrangements exists.

# COUNTRY MODELS FOR SSRE

- Spain
- Italy
- France
- UK
- Belgium
- Australia
- USA

# COUNTRY MODEL. SPAIN

## Policy/Regulation/Incentives

- The regulation establishes the right to a remuneration for the electricity fed to the grid from installations below 100 kW. Installations higher than 100 kW are not considered prosumers.
- Installations between 15 and 100 kW need to process a connection point with a distribution company.
- For installations between 15 kW and 100 kW excess energy injected into the grid is remunerated at market price. Costs include: a variable charges component associated with the system costs and determined from the variable terms, a capacity payment component for system support, compensation to the market and system operators, interrupted service and adjusted service.
- For small installations of up to 15 kW no permit required.
- Production and consumption are metered by two bi-directional meters: one in the owner's site and a 2<sup>nd</sup> at the grid frontier point.

Source: PV PROSUMER GUIDELINES FOR EIGHT EU MEMBER STATES. European Renewable Energies Federation (EREF). Brussels, May 2019. [https://www.pvp4grid.eu/wp-content/uploads/2019/05/1904\\_PVP4Grid\\_Bericht\\_EUnat\\_web.pdf](https://www.pvp4grid.eu/wp-content/uploads/2019/05/1904_PVP4Grid_Bericht_EUnat_web.pdf)

# COUNTRY MODEL. ITALY

## Policy/Regulations/Incentives

- An Italian law defines a “self-producer” which allows self-generation and self-consumption of renewable energy.
- There are no restrictions on the size of RE systems installed for self-generation and no limits on the amount of electricity that can be fed into the grid.
- There is an obligation of the system operator to buy electricity from RE producers and individual self-consumers.
- There are support schemes for RE electricity, such as:
  - a favorable VAT regime (10% instead of 20%),
  - real estate tax deductions,
  - possibility to sell RE electricity on a guaranteed minimum price.
- Net-metering can be applied to final customers with RES plant up to 500 kW or high efficiency CHP plants up to 200 kW.

Source: Energy Policy 138 (2020) 111212. 28 December 20190301-4215/© 2019. Published by Elsevier Ltd. Regulatory challenges and opportunities for collective renewable energy prosumers in the EU. <https://reader.elsevier.com/reader/sd/pii/S0301421519307943?token=4FEA8154DDA21369AD2DC9D5A0A33553B5C1A9E9A5982335C5D7ACF90462D0182BCF4828902E09CE207BB4D3FA5A4D2E>

# COUNTRY MODEL. FRANCE

## Policy/Regulations/Incentives

- Regulatory framework for self-consumption was introduced since 2017. PV self-consumption installations up to 100 kW are authorized. For bigger systems there are tenders. Installations with capacity <100 kW can receive a FIT.
- Direct support schemes:
  - i) FIT contracts for small scale solar (<100 kW) include an investment premium when part of the energy is self-consumed. The aid is granted on each kWh injected to the grid;
  - ii) self-consumption of RES electricity is encouraged through tendering procedures. Selected plants receive a fixed premium on each kWh, with a markup on self-consumed electricity.

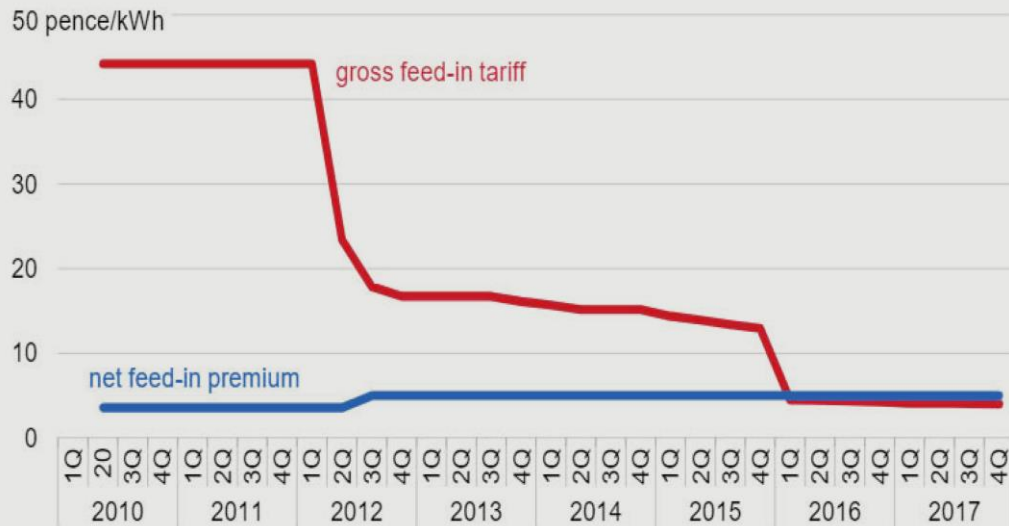
### Indirect support scheme:

- i) since 2017, all self-consumed electricity is exempt from electricity consumption taxes on electricity;
- ii) since 8/2018, consumers self-consuming groups may opt for a network tariff and rebate on self-consumed electricity, plus a markup on electricity purchased from the grid.

# COUNTRY MODEL. UK

## Policy/Regulations/Incentives

- The UK introduced a FIT scheme for small systems in 2010. Tariffs were initially designed to give ROI of 5% paid for 25 years.
- 2 years after its launch, rapid capex reductions increased ROI and registrations exceeded expectations. Tariff cuts followed and FIT was reduced to 20 years.
- Since the changes in 2012 tariffs have been revised every 3 months based on uptake levels. Deployment caps were introduced in 2016.
- These limit the capacity that can receive a FIT rate. If deployment caps are reached, installations are queued for next period's tariffs.



Source: Bloomberg New Energy Finance, Ofgem Note; Tariffs shown apply to systems less than 4kW until 1Q 2016 and less than 10kW thereafter (due to changes in the system size bandings in the regulation) installed at properties with an Energy Performance Certificate rating of D.

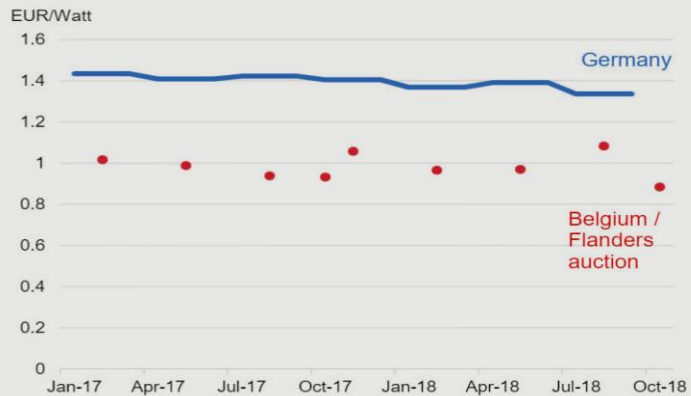
# COUNTRY MODEL. BELGIUM

## Policy/Regulations/Incentives

- The Belgium energy market is split into 3 regions, each with own regulator, policy & targets.
- Introduced in 2009, the Flanders Green Certificate Scheme was a traded market providing a lower value-stream than most European FITs. Green certificate prices were bound by a minimum of 65 euros/MWh, capped by a shortfall penalty of 100-125\* euros/MWh. In 2013 this was replaced by a net metering regime.
- The Wallonia Green Certificate Scheme was similar. It was replaced in 2014 with Quali watt system, which provides annual subsidy payments to PV users in the first 5 years of the system life. Payments are calibrated for an 8-year payback for a 3kW system. In 2018 Wallonia replaced Quali watt with a net metering scheme.

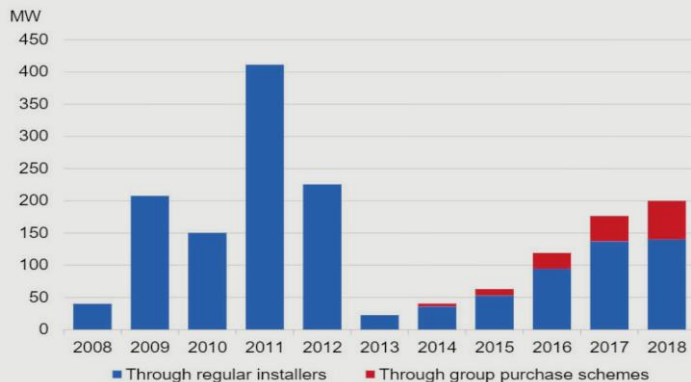
\* Solar projects were initially eligible to create green certificates for 20 years. This was reduced to 10 years in 2012. the shortfall penalty was also adjusted over time

## Residential prices offered in group purchase plans in Belgium compared to average German residential prices for a 4kW system



Source: Bloomberg New Energy Finance, iChoors, BSW-Solar. Note: Flemish prices are offered for multicrystalline modules with 6% VAT, as a standard offer (i.e. a house of maximum two floors, with a tile roof, no customization needed). Houses newer than 10 years pay 21% VAT and houses that require customization face extra costs.

## Residential capacity installed in Flanders



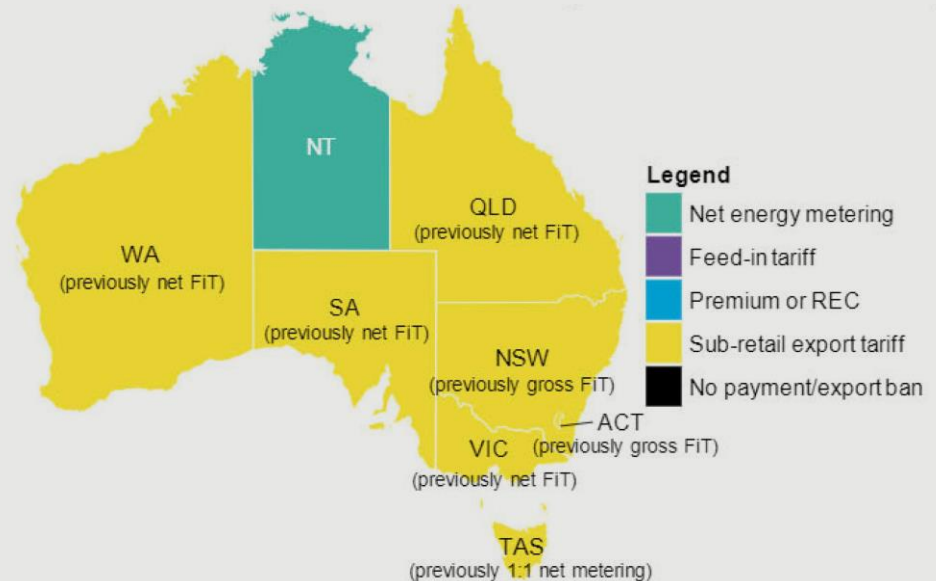
Source: Bloomberg NEF, Flemish Energy Agency (VEA). Note: 2018 data is forecast as of October.

# COUNTRY MODEL.AUSTRALIA

## Policy/Regulations/Incentives

- Most AUS states & territories suspended generous FITs for early rooftop PV adopters.
- In the east, “gross” & “net” FITs were replaced with export tariffs between USD 5-17 cents/kWh. This incentivizes customers to install storage to arbitrage between export tariff and retail rate.
- Southwest Australia pays USD 5,4 USD cents/kWh for excess generation, whereas Western Australia USD 7.6-38.2 USD cents/kWh.

## Small-scale PV compensation mechanism by Australian state and territory



Source: Bloomberg New Energy Finance.

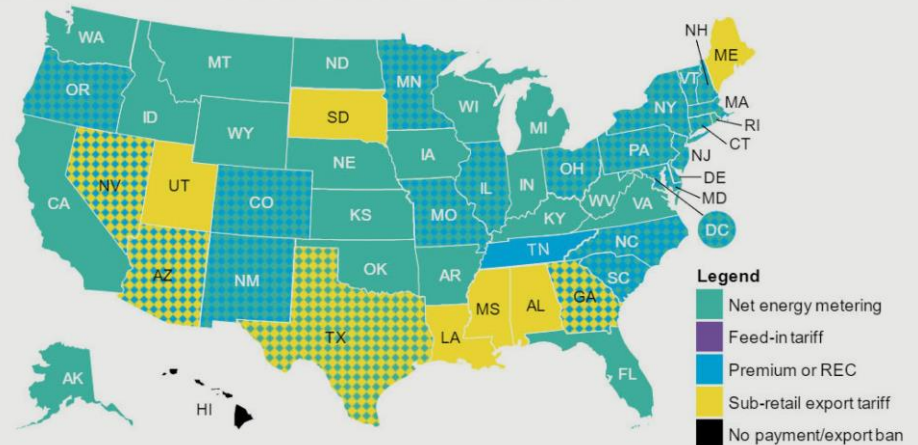


# COUNTRY MODEL. USA

## Policy/Regulations/Incentives

- U.S. state legislators favor net energy metering for small PV. As of 2017, net metering at full retail rates is available customers in 39 states.
- In 2013 regulators allowed Arizona Public Service (APS) to charge \$0.7/kW monthly to new solar customers to slow Arizona's residential solar boom;
- Recently, net metering was discontinued in several states, replaced by sub-retail export tariffs. APS replaced net-metering with an export tariff set at 5-year average utility-scale PV PPA rate.

## Small-scale PV compensation mechanism by U.S. state or major utility



Source: Bloomberg New Energy Finance. Note: Hatched colors indicates compounding incentives. States colored 'Premium or REC' (blue) have either a solar or DG RPS carve-out. Where mechanisms vary within a state, the map reflects the largest utility in the state. See: [Behind-the-Meter: U.S. Primer \(web | terminal\)](#)

## COUNTRY MODEL. USA CONT

- Utah introduced a 3-year export tariff until a “value of solar” export tariff is determined. Both schemes allow self-consumed energy to offset retail consumption.
- California mandates net-metered customers be placed on time-of use (TOU) tariffs. Each block’s time and price is subject to regular review. This incentivizes storage for arbitrage between on- and off-peak retail tariffs.
- Georgia, Mississippi, Alabama and South Dakota offer lower export tariffs like those in Arizona and Louisiana.
- Several states have incented solar build using traded solar certificates (SRECs).

# TRENDS IN SSRE DEVELOPMENT. TECHNOLOGIES

## Activities/facilities in operation:

- **Aggregation** - activity of providers that contract with the individual demand sites and aggregate them so that their potential can be offered to TSO, DSO or BRP ((Balancing Responsibility Provider).
- **Microgrids** - local energy grids with control capability that can disconnect from the traditional grid and operate autonomously.
- **Demand-side management** of DER/SSRE (DMS) – a combination of DER/SSRE which is implemented to encourage consumers to modify their level and pattern of electricity use.
- **Distributed energy resource management systems (DERMS)** - a software platform that is used to organize the operation of the aggregated DER within a power grid and cooperates with DSO.
- **Virtual Power Plants (VPPs)** - facilities which aggregate producers, consumers and storage units. Aggregation is provided independently of location.

# CONCLUSIONS

- Popularity of residential PV installations is booming thanks to continuous government support schemes, storage and declining system costs.
- Most countries evolved from FITs to market based approach for SSRE support.
- RE promotional programs evolve constantly and need flexibility. They must balance the system's and market needs with prosumer opportunities.
- New network technologies and business models have a big impact on the direction of SSRE.

Thank you for the attention.

Questions?

# Energy Security Project

THANK YOU!



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