



WEBINAR

Innovations for a decentralised renewable-powered system: Peer-to-peer electricity trading

**Moderated by:
Arina Anisie, IRENA**

Tuesday, 25 August 2020 • 10:00 CEST / 16:00 GMT+8



Welcoming remarks

Ir Dr Sanjayan Velautham, CEO, SEDA



SPEAKERS



Hazril Izan bin
Bahari, SEDA



Francisco Boshell
IRENA



Dr Jemma Green,
Power Ledger



Vinod Tiwari,
Power Ledger



AGENDA

**Innovations for a
decentralised renewable-
powered system:**

**Peer-to-peer electricity
trading**

Opening Address

- 1. Renewable integration and power system decentralisation, Francisco Boshell, IRENA**
- 2. Malaysia P2P Energy Trading Pilot Project, Hazril Izan bin Bahari, SEDA**
- 3. Blockchain energy use-cases and real applications deployed around the world, Dr Jemma Green and Vinod Tiwari, Power Ledger**

Q&A



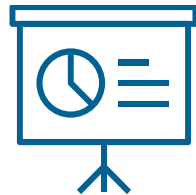
All of you are **muted** and will remain so throughout the webinar



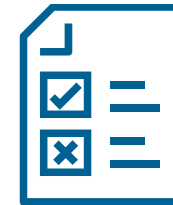
Use the **Chat** feature to introduce yourself and talk to other attendees



If you have **Questions** to the speaker please use the **Q&A**



The slides and recordings will be shared via email after the webinar



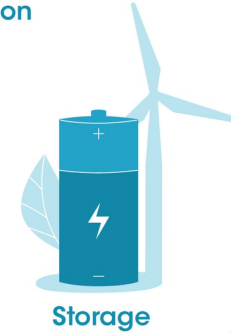
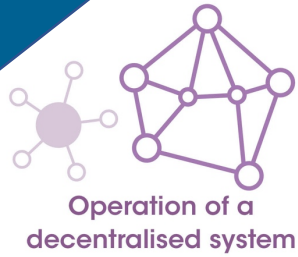
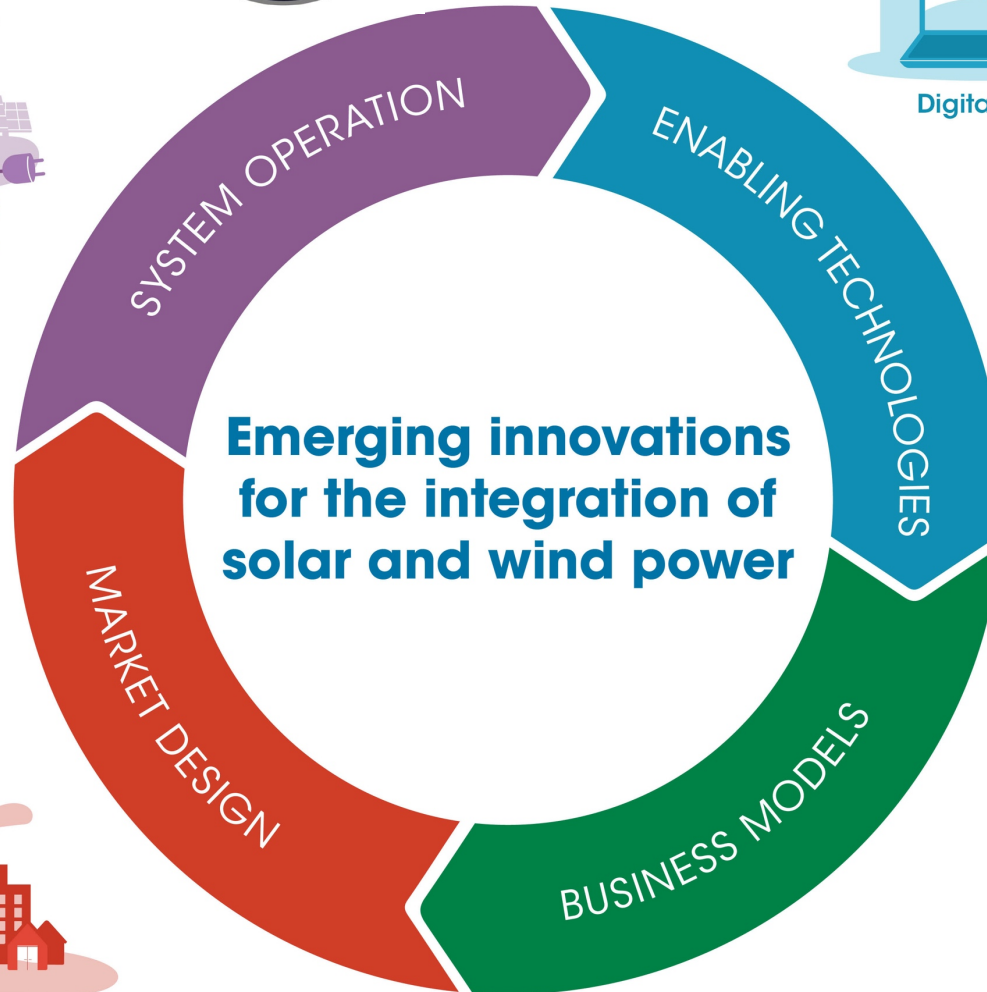
Tell us how we did in the survey to help us improve



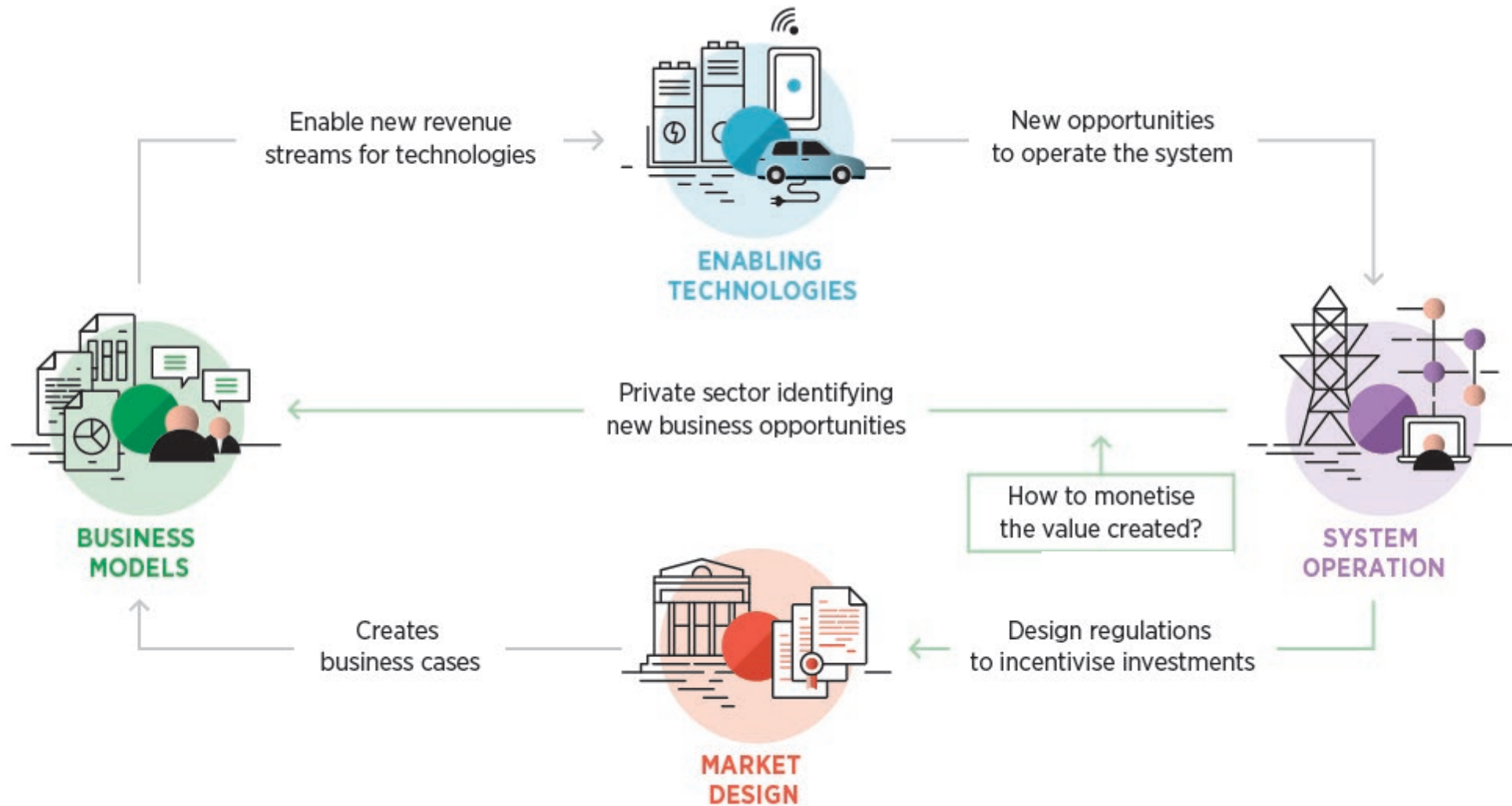
OPENING ADDRESS

Innovation Landscape report for a renewable-powered future

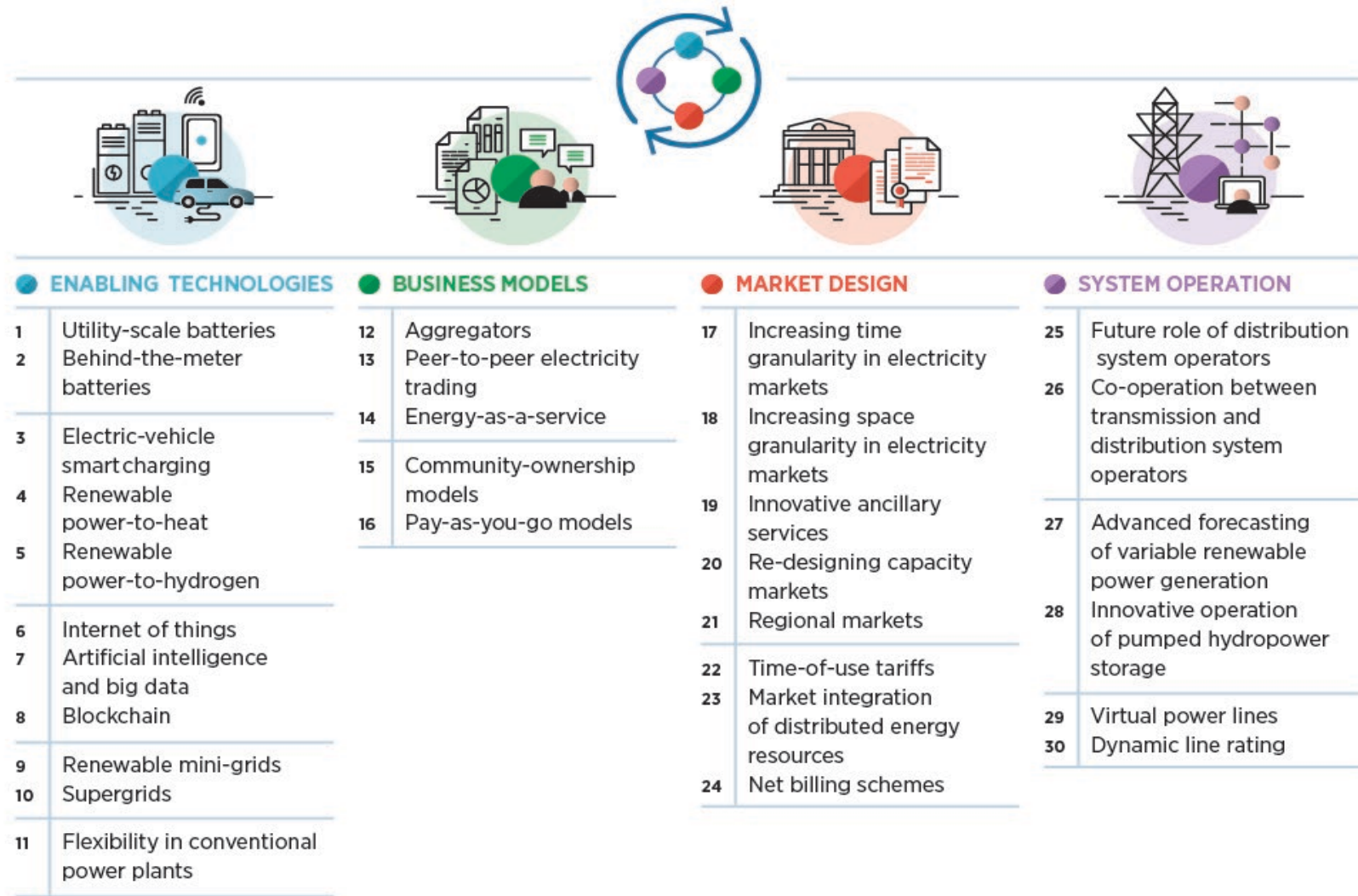
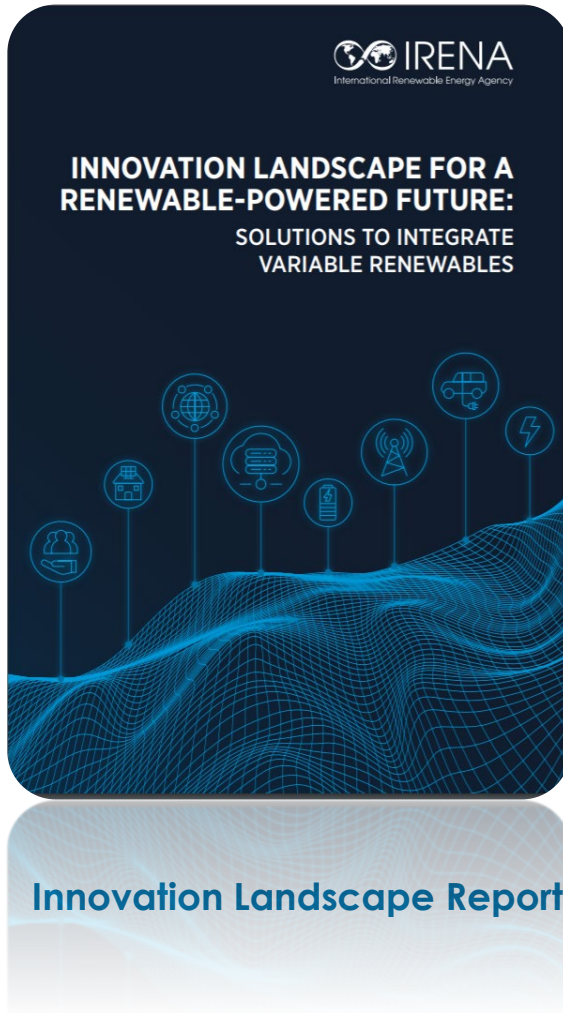
Arina Anisie, IRENA



Systemic innovation for an integrated renewable energy system



Emerging innovations for wind and solar PV integration



30 Innovation Briefs



30 Innovation Briefs





Renewable integration and power system decentralisation

Francisco Boshell, IRENA

Power systems transition propelled by three trends

- Electrification of end-use sectors is an emerging solution to **maintain value and avoid curtailment of VRE**, and help decarbonize other sectors



- The increasing deployment of Distributed Energy Resources (DERs) turns the consumer into an active participant, **fostering demand-side management**.
- Digital technologies enable **faster response, better management of assets, connecting devices, collecting data, monitor and control**

Consumers at the center of the transition

The new consumer is also producing, storing, trading energy and managing own load

DISTRIBUTED GENERATION

Generation from plants connected at low and medium voltage, such as solar rooftops, micro wind turbines, etc.

BEHIND-THE-METER BATTERY

Small batteries that are connected at the consumer end and store electrical energy during periods of surplus generation.

SMART CHARGING ELECTRIC VEHICLES

Optimising the charging cycle of the EVs according to distribution grid constraints and local renewable energy availability, as well as driver preferences.

DISTRIBUTED ENERGY RESOURCES

DEMAND RESPONSE

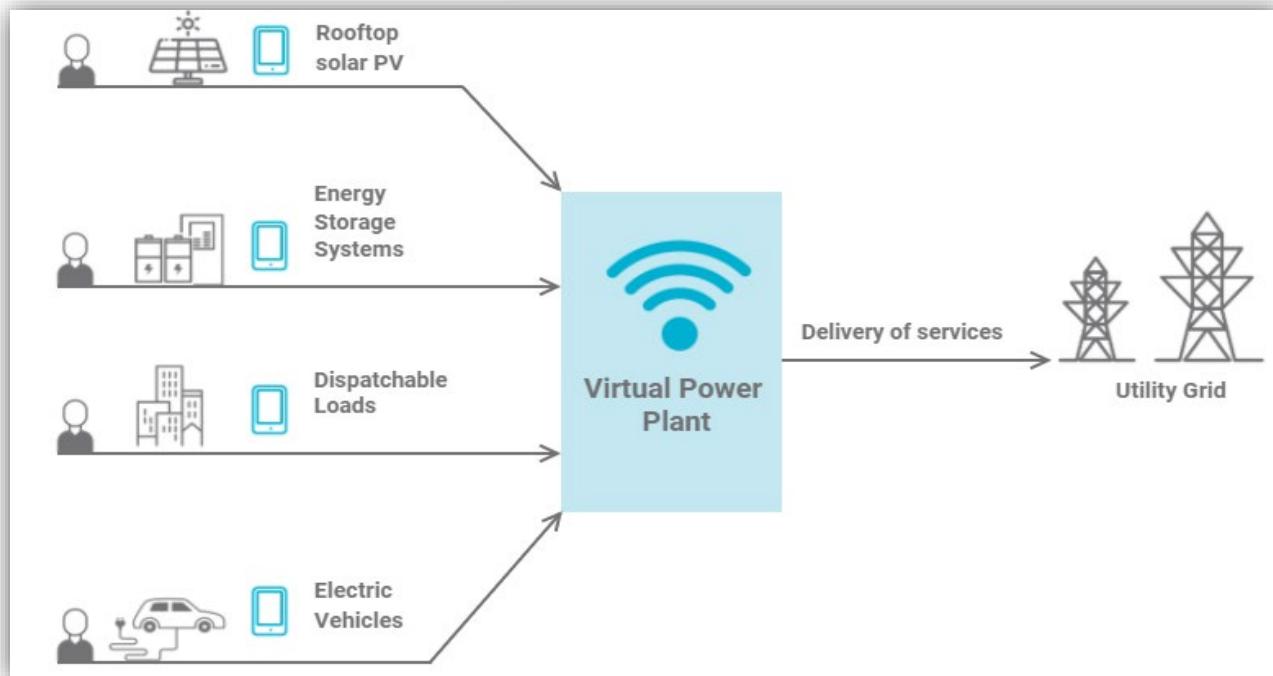
Process that enables consumers to alter their electricity consumption patterns and provide grid services, individually or through an aggregator.

POWER-TO-HEAT

Thermal boilers, heat pumps, thermal storage, etc. used to provide heat for residential purposes.

Innovative business models emerge: Aggregators

Description	Value
Virtual power plant (VPP) global market value	USD 762 million in 2016; expected to reach USD 4 597 million in 2023 (compound annual growth rate of 25.9% from 2017 to 2023) (Research and Markets, 2018)
Countries with established regulatory frameworks allowing VPP trading	Australia, Austria, Belgium, Germany, Denmark, France, Netherlands, UK, US, etc.
Services provided by aggregators	<ul style="list-style-type: none">• Forecasting and trading of distributed energy resources• Optimised dispatching of distributed energy resources according to intraday pricing on spot markets• Delivery of ancillary services to transmission (and potentially distribution) system operators

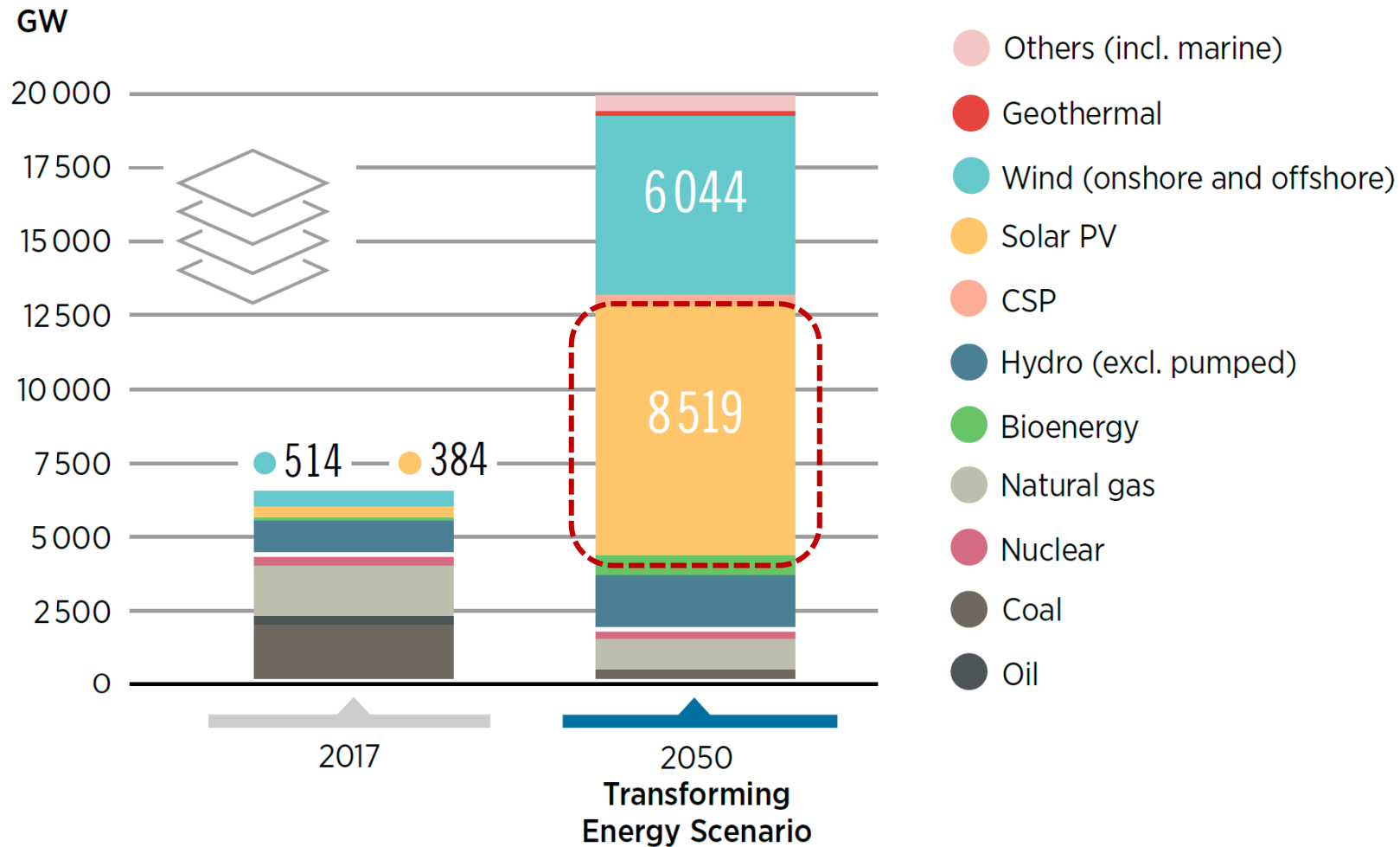


In South Australia, aggregators can meet 20 % of daily power demand and provide 30 % savings on energy bills.

Source: IRENA (2019) Innovation landscape brief: Aggregators

Distributed PV to play an important role in the Global Energy Transformation

Breakdown of total installed capacity by source, 2017-2050

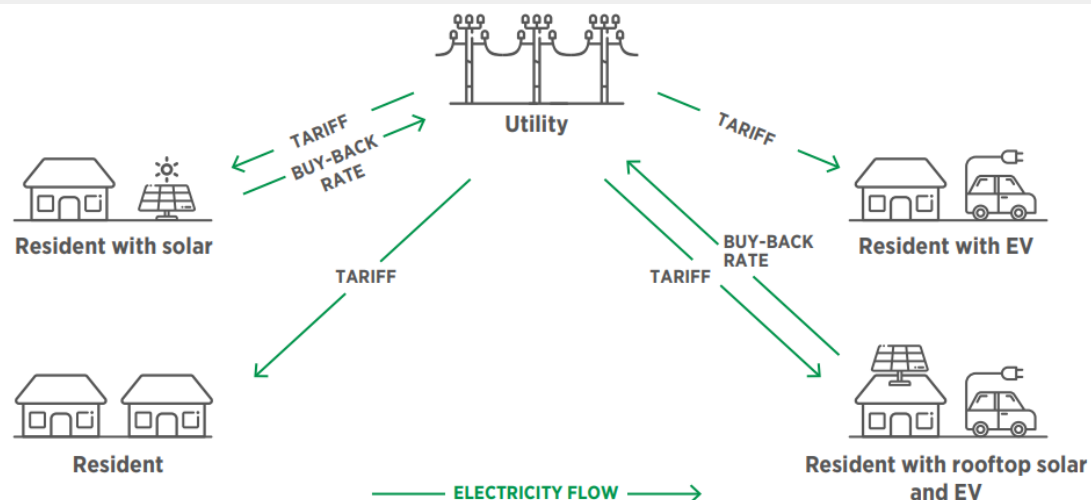


Global distributed PV cumulative installed capacity

- Today: **220 GW** (~ 35% of all PV capacity)
- by 2050: **3,400 GW** (~ 40% of all PV capacity)

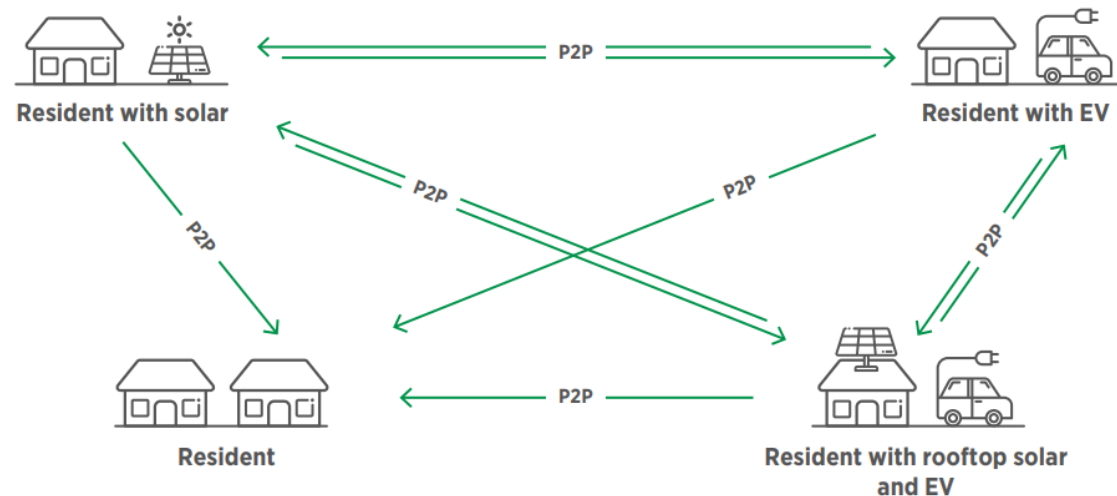
Innovative business models emerge: Peer to peer trading

Traditional trading model



Source: Adapted from Liu *et al.*, 2019

Peer to peer electricity trading model



Global electricity generated
by distributed PV ~ 350 TWh

2 KEY ENABLING FACTORS

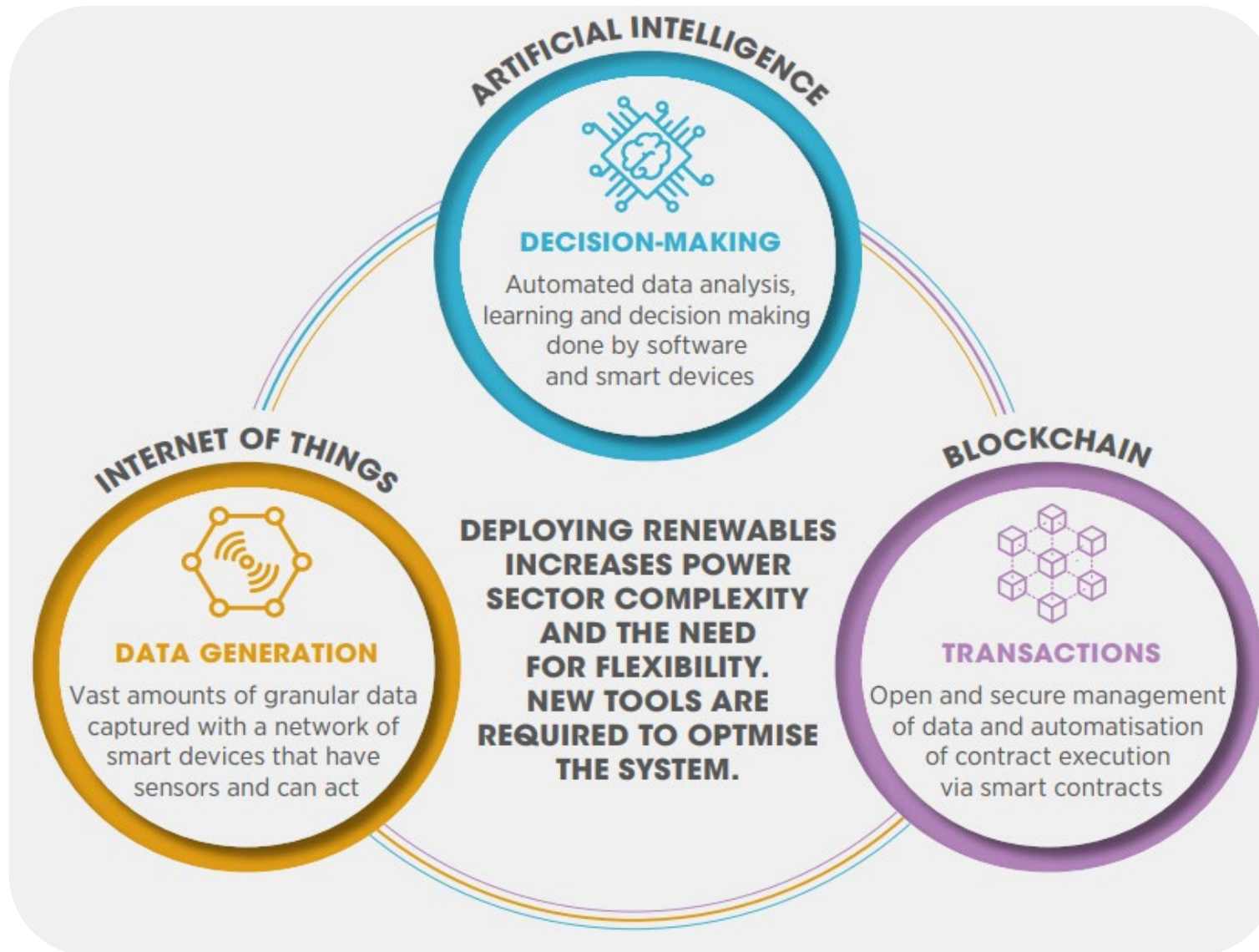
-  Distributed renewable energy resources
-  Digitalisation
-  Conducive regulatory framework

3 SNAPSHOT

- Australia, Bangladesh, Colombia, Germany, Japan, Malaysia, the Netherlands, the UK, the US and others have started trial P2P schemes.
- Many pilot projects used blockchain technology.

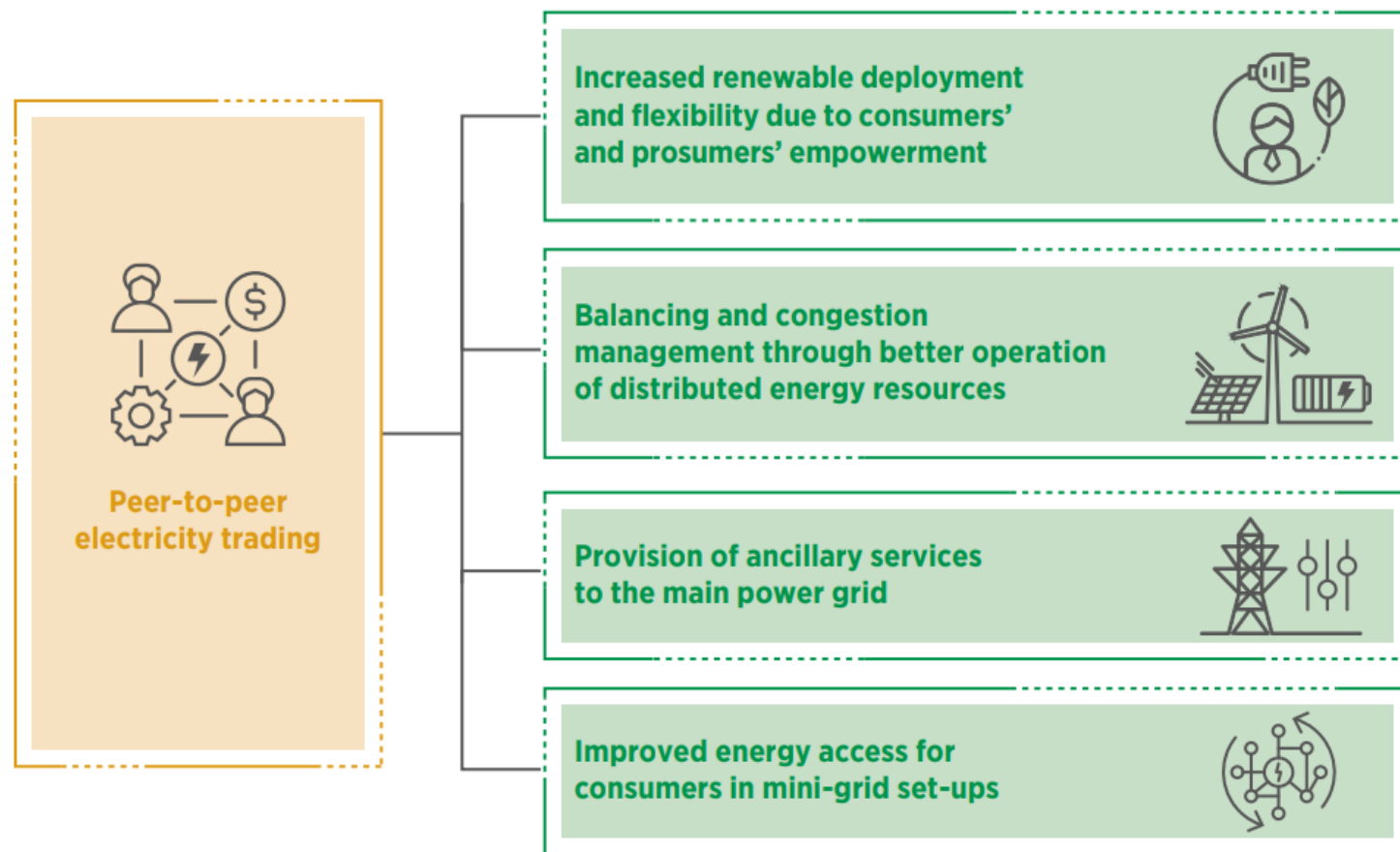


Decentralisation needs digitalisation



Smart technology must result in smart solutions for the power sector

Decentralisation can be a source of flexibility for power systems, but...



...Smart technologies need to be used in a smart way.

Consider both - user and system needs:

- Maintain or improve services to users at same or lower cost
- Promote users behaviour that alleviate instead of stressing more the system
- Observe market principles, consumer rights, the cost sharing principles applied to energy grids
- Appropriate electrify tariff structure - adequate grid charges if exchanges are carried out using the public infrastructure

***Value from demonstration projects and regulatory sandboxes**



Malaysia P2P Energy Trading Pilot Project

Hazril Izan bin Bahari, SEDA

Introduction

The objectives of the pilot run are:

- Simulate energy trading patterns between Prosumers and Consumers;
- evaluate technical and financial impact of P2P energy trading sandbox;
- identify regulatory changes required to facilitate nationwide P2P energy trading adoption
- identify enablers that will encourage the participation of Prosumers and Consumers; and
- Identify the challenges and risks in operationalizing the P2P energy trading

The regulatory sandbox was approved by the Energy Commission commencing November 2019 until June 2020 with the key provisions:

- Interim System Access Charge (SAC) / Network charges of 6.3 sen/kWh;
- No retail or platform charges imposed;
- Allow NEM prosumers and consumers to trade electricity;
- Any untraded electricity from prosumers will be accepted by TNB @ zero cost.

What Are We Looking



Concept of P2P pilot project in Malaysia : Peer-to-peer electricity trading across the electricity network (TNB's grid)

P2P energy trading occurs when Prosumer sells **excess** solar electricity on an energy trading platform to another consumer at a rate **competitive** to retailer's tariff

**Prosumer
(Net Energy Metering
user)**

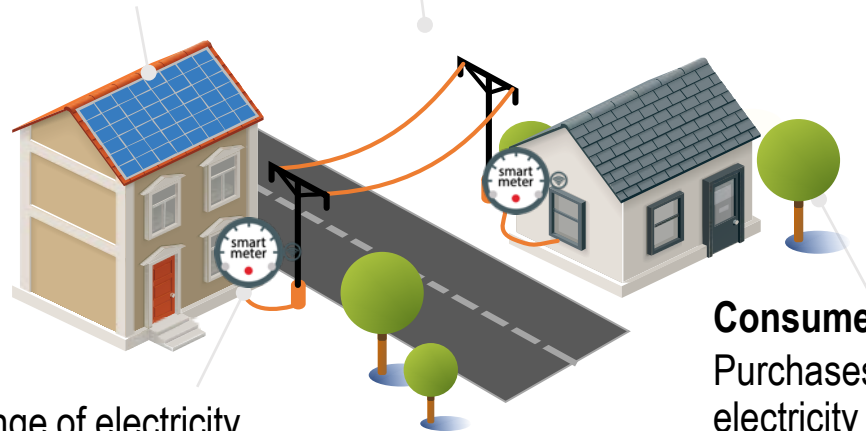
Produces excess
electricity from own
rooftop solar panels

Utility (TNB)

Use of Utility's grid, meter
and billing system

Smart meter

Record exchange of electricity
between prosumer, consumer &
TNB, tracked via blockchain
platform



Consumer

Purchases excess
electricity from
prosumer when
available; rest of the
time to purchase
from TNB

Timeline: 8 months
pilot project

Participation	No
Prosumer	6
Consumer	8

<http://www.seda.gov.my/2019/10/malaysias-1st-pilot-run-of-peer-to-peer-p2p-energy-trading/>

Source: SEDA

Challenges and Mitigations



Infrastructure

- Integration
- Data Format
- Data Communication
- Data Processing From Meter To Trading Platform

Mitigations

- SEDA developed a data aggregator which integrated meter data from TNB Billing system and submitted to Power Ledger's P2P Platform



Recruitment

- Identify suitable Consumers and Prosumers

Mitigations

- Evaluated history data and ran the simulations



Energy Trading

- Energy generated need to be balanced with the consumption to reduce spillage and zero energy cost
- Zero energy cost is a loss to the prosumers

Mitigations

- Identified suitable energy profiles between prosumers and consumers to optimize trading



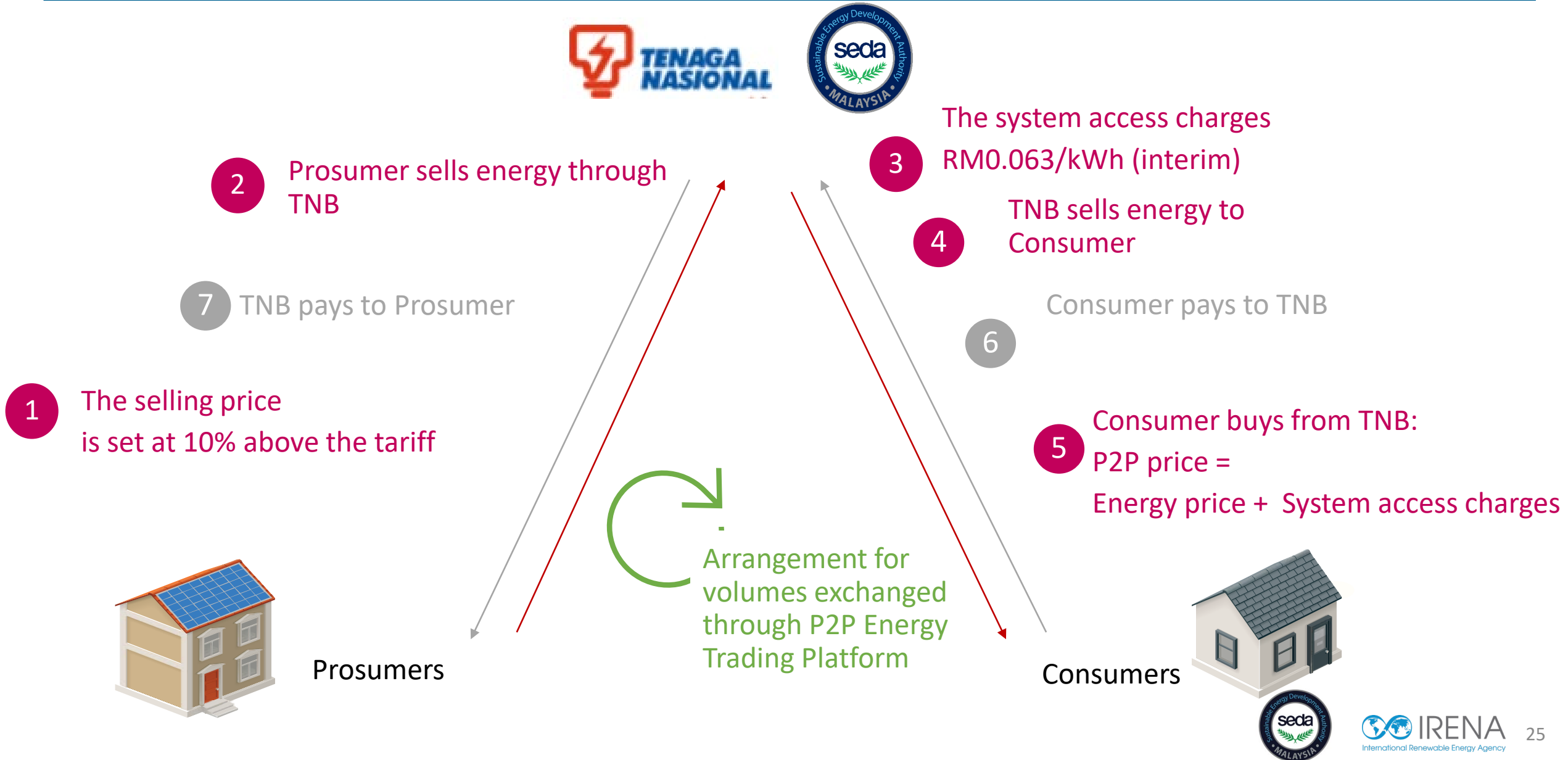
Process

- Trading Process (algorithm, pricing, SAC)
- Settlement Process. To reduce risk, ensure fair and transparent.

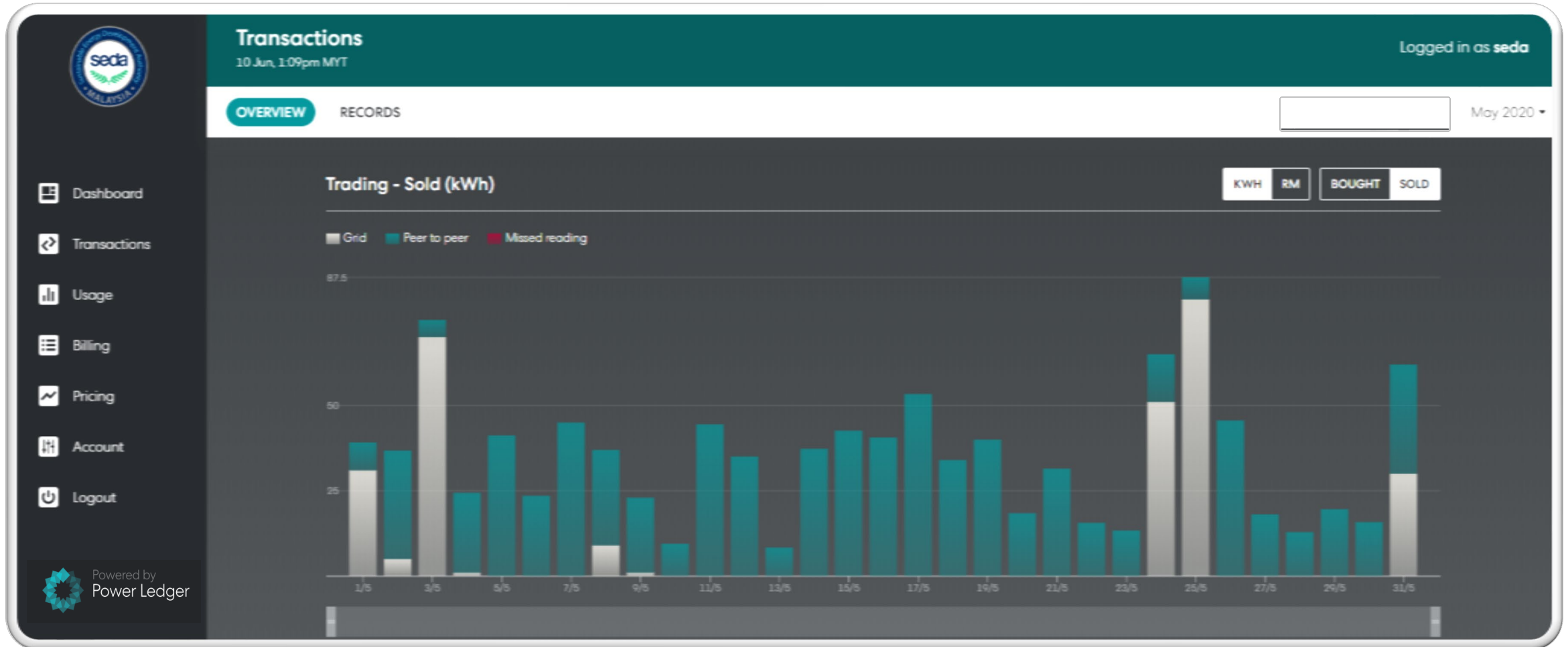
Mitigations

- TNB assumed the role of a 'clearing house' for the settlement during the sandbox period

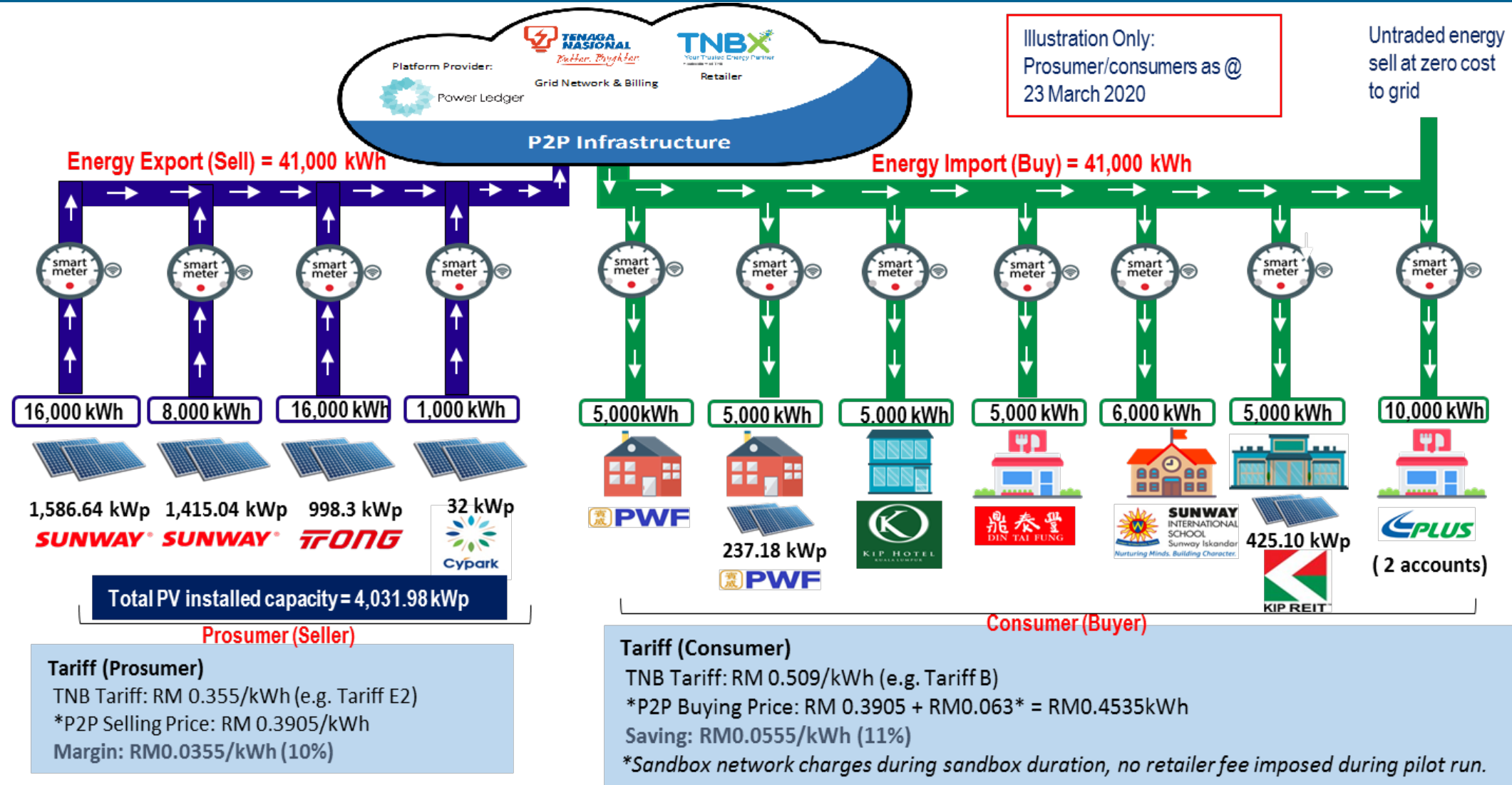
Settlement Process Between Prosumers and Consumers



P2P Energy Trading Platform : Dashboard



List of Prosumers and Consumers



Key Takeaways



Infrastructure

- Need to have a seamless integration spanning the data collection, trading, billing and settlement process
- Standardization of meter data format to ease the integration with the platforms (P2P energy trading, billing and settlement)

Participation

- Participants decision to take part are strongly based on economic return (Savings, margin, risks, etc)
- Simplify the process to attract the participation

Risks

- The untraded energy can be a risk to the prosumers in terms of financial loss. Thus, it is important to balance by increasing more consumers or providing a compensation rate.
- Retailers play important role in settlement, reducing the counter party risk and being buyer-of-last resort.

Others

- System Access Charge/ Network Charge provide market signal on the commercial viability



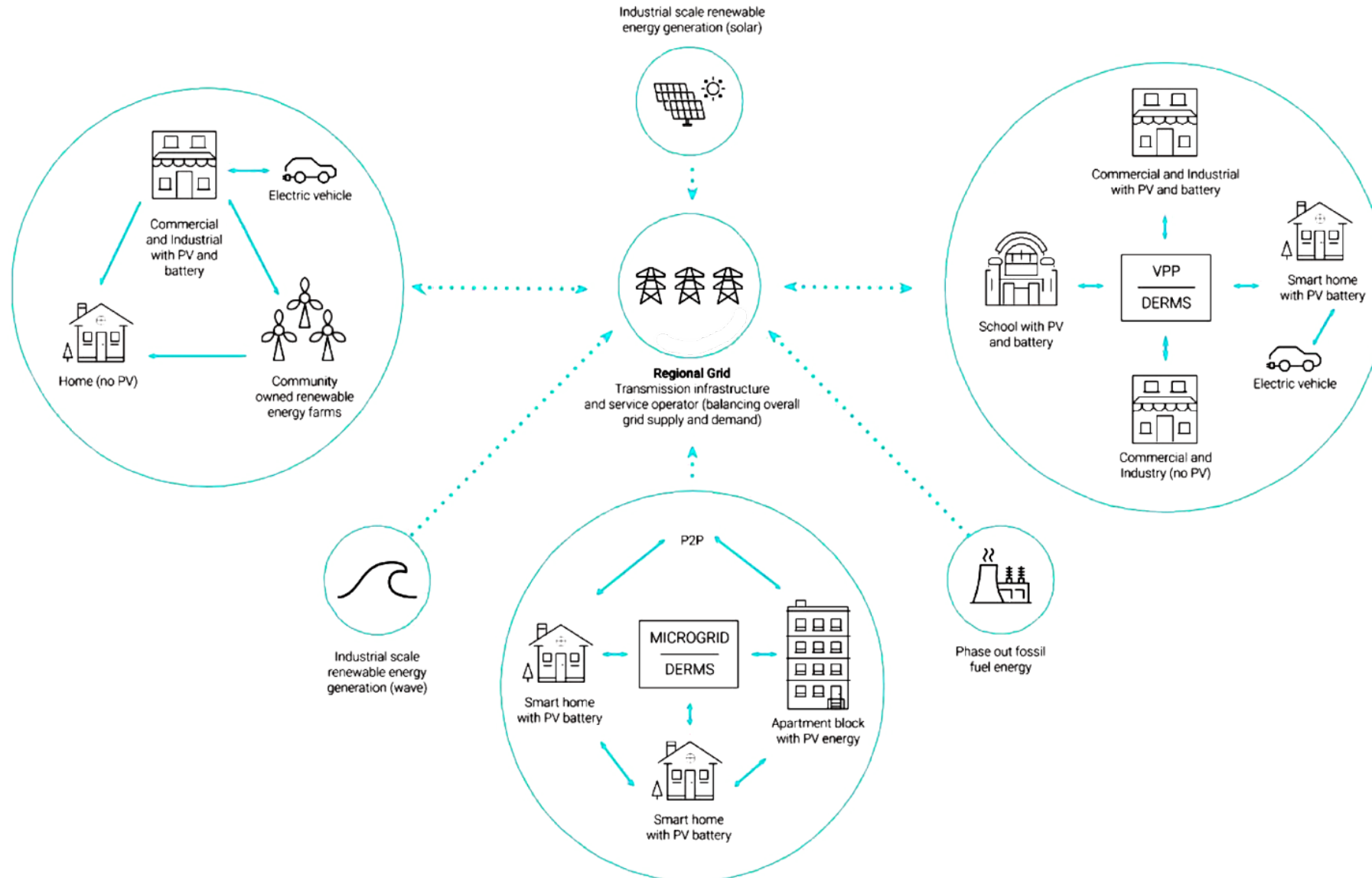
Blockchain energy use-cases and real applications deployed around the world

Dr Jemma Green and Vinod Tiwari, Power Ledger

The traditional energy system



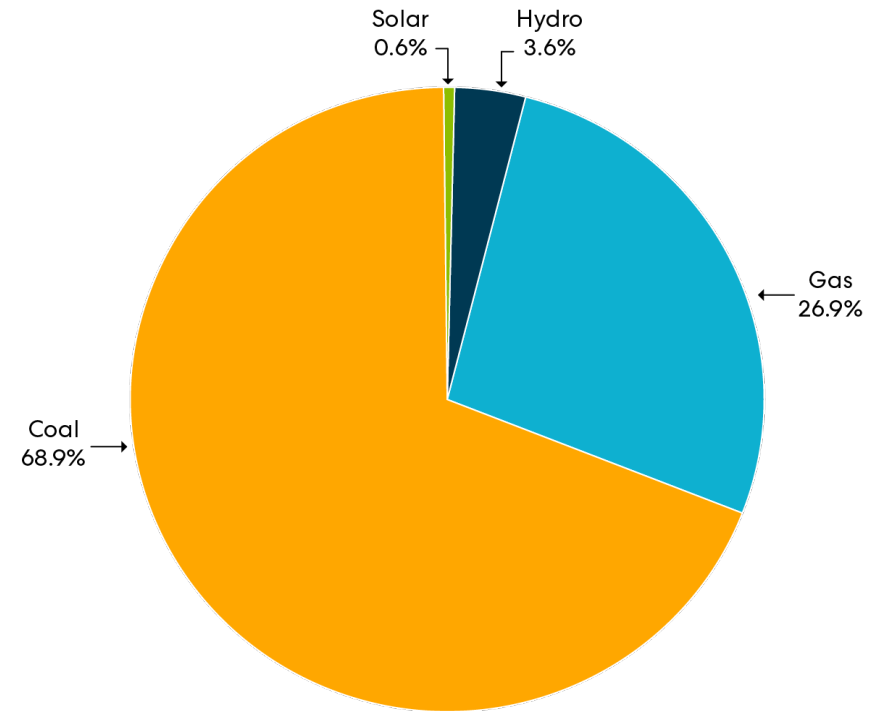
Distributed energy systems



Market context - Malaysia

1. Gas and coal still biggest generation sources by far
2. Malaysia aims to achieve 20% renewable generation mix by 2025
3. Need to encourage sustainable PV generation

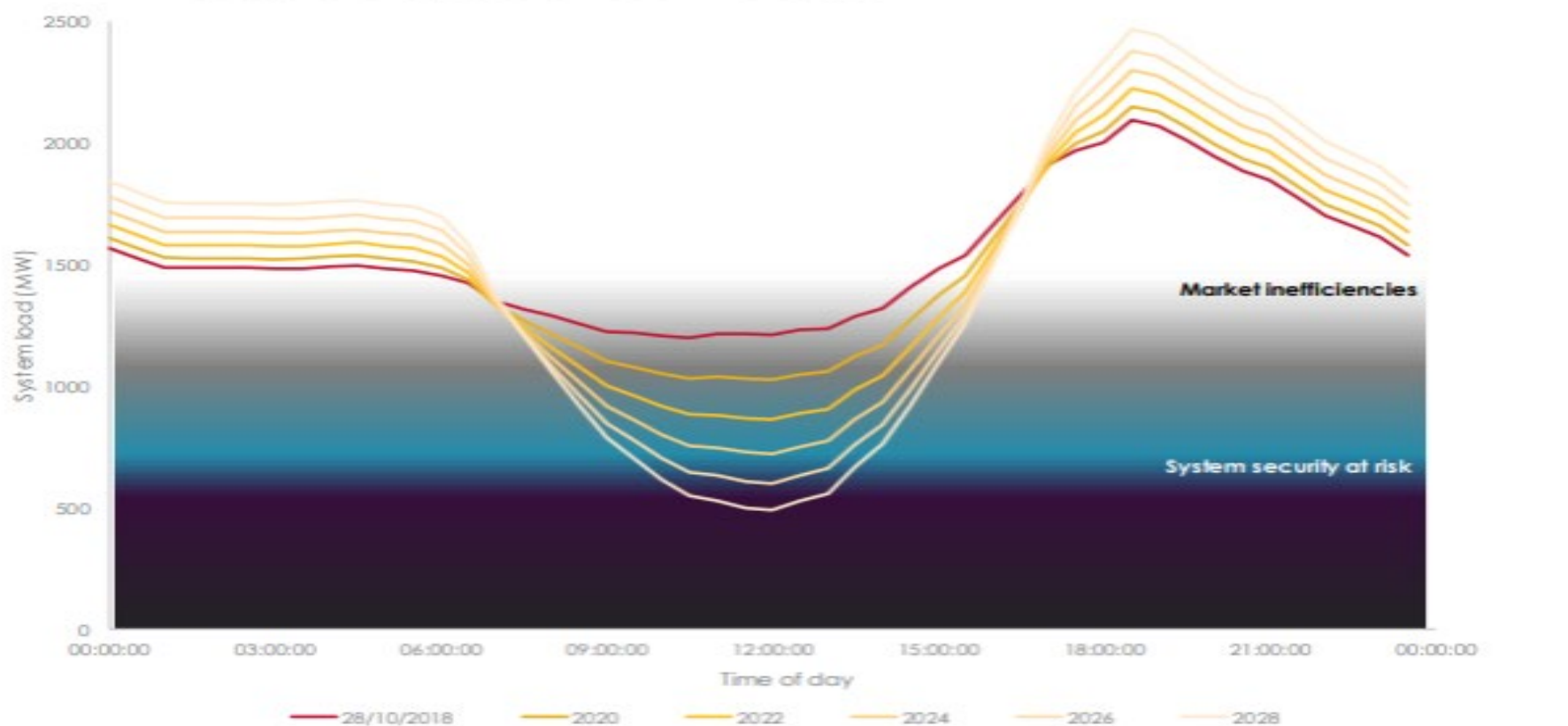
Overall 1 August 2020 - 31 August 2020



Source: Annual Generation Mix, Single Buyer

The duck curve headache- why renewables are difficult

Figure 9 AEMO's analysis on the shape of the load curve on the minimum demand day, 2018 actuals forecast to 2028, based on ESOO PV forecasts



Source: Integrating Utility-scale Renewables and Distributed Energy Resources in the SWIS, AEMO 2019

Market context - Network pricing

Many electricity markets around the world are implementing network pricing reform to better integrate Distributed Energy Resources (DERs):

- **ERCOT - Texas, USA**
- **ofGem - UK**
- **EA-NZ - New Zealand**
- **Swissgrid - Switzerland**
- **Privatised - Chile**
- **Caiso - USA**

Source: Power Ledger research



Power Ledger's market-making technology makes renewables scalable without the headaches and helps retailers invent new business models to capture value.

Power Ledger's software platform

Energy trading

xGrid, μ Grid

VPP

Vision, PPA Vision

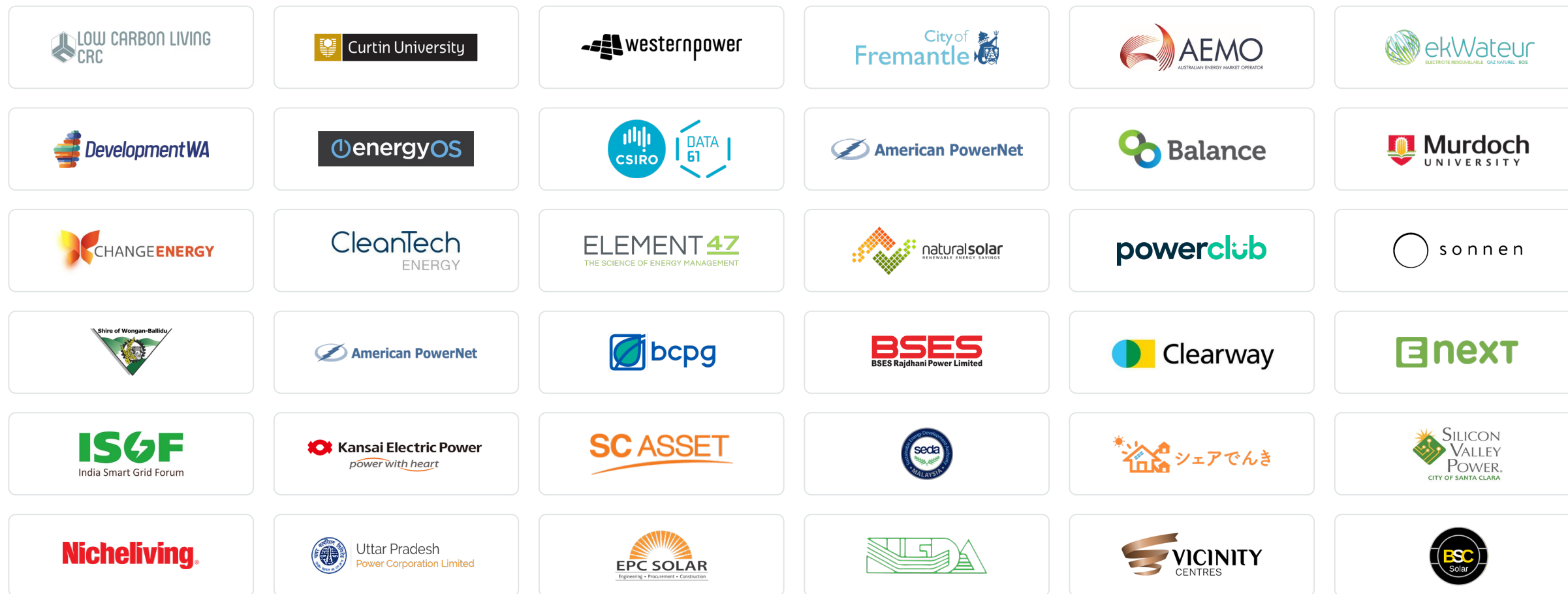
Environmental commodities trading

Trace

TraceX



Power Ledger has more than 20 projects in 10 countries



Why blockchain?

Faster settlement

Smart contracts

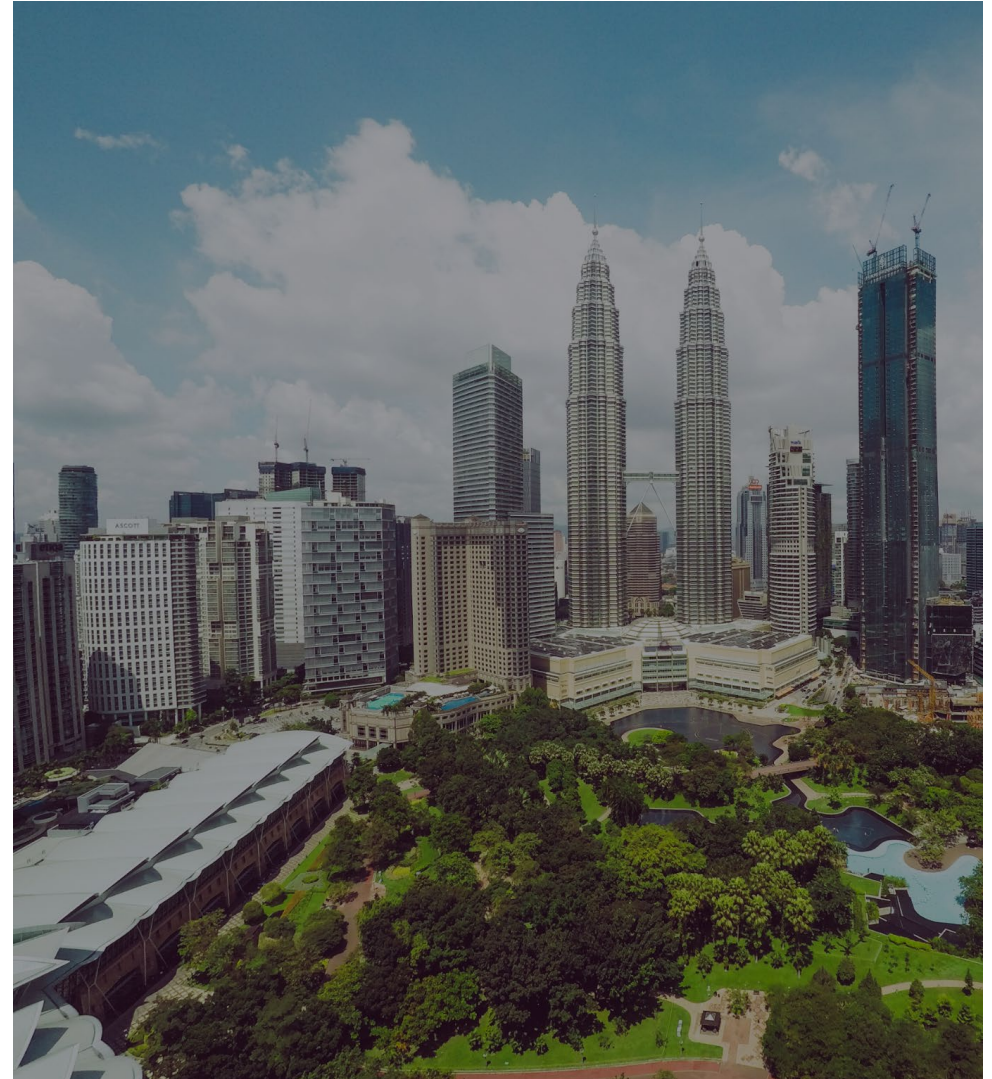
Cross-retailer trading

Enhanced auditing



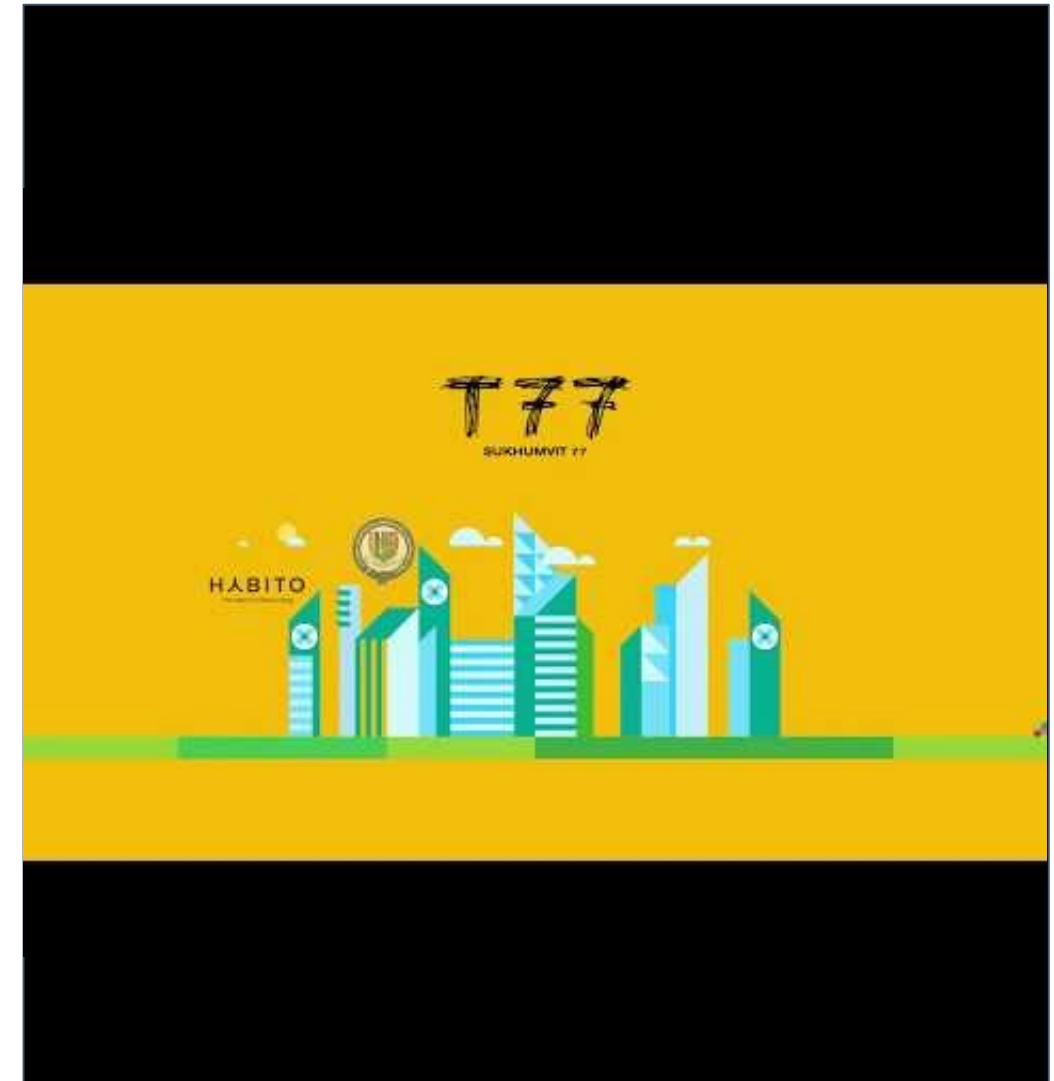
Sustainable Energy Development Authority (SEDA Malaysia)

- Malaysia's 1st foray into P2P trading allowing Net Energy Metering (NEM).
- Trial ran from November 2019 until June 2020 w/ SEDA and national utility TNB.
- Trial demonstrated that P2P energy trading can encourage growth of rooftop solar in a scalable way.



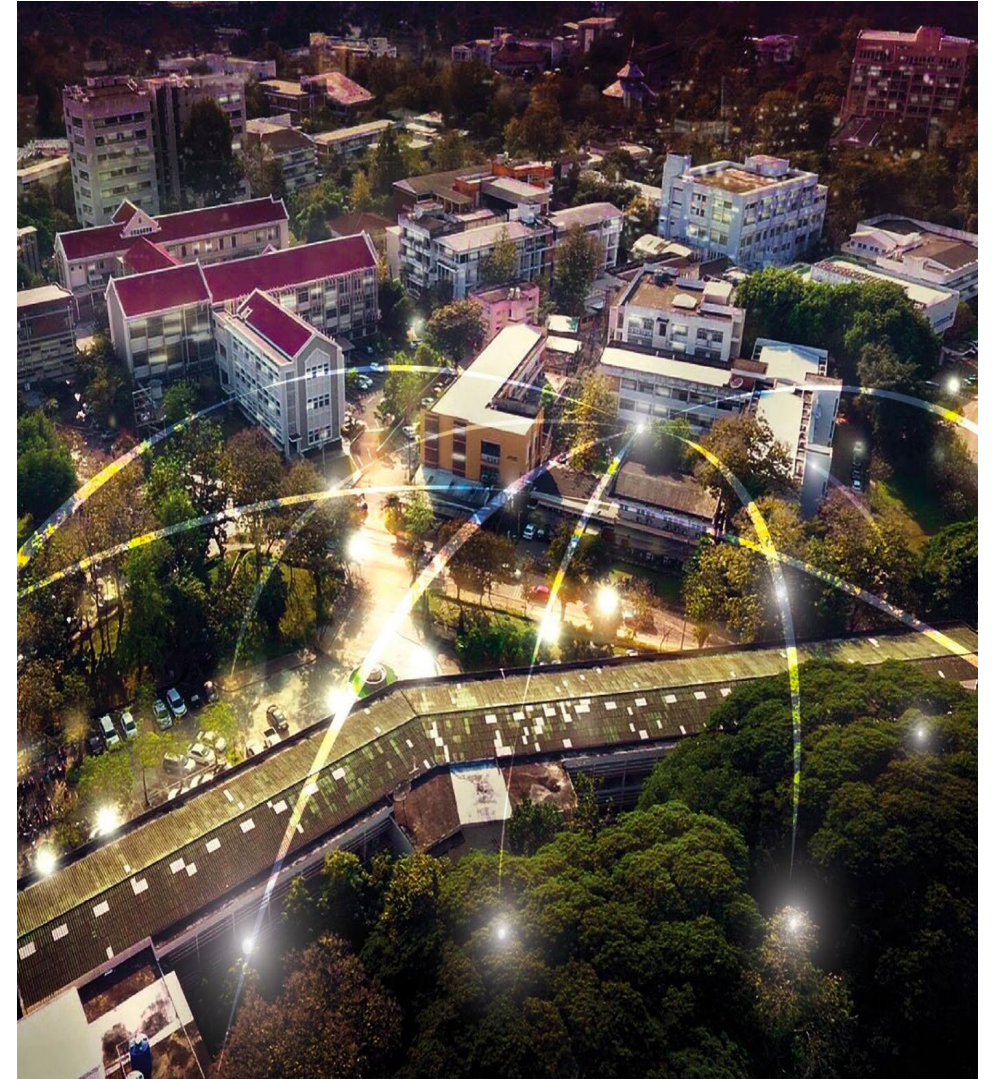
BCPG - T77 Precinct Bangkok, Thailand

- Project commenced in October 2018 with 700 kW solar trading across 6 commercial sites
- Largest commercial P2P trading project in the world
- Investments in additional solar capacity being investigated onsite.



TDED National Partnership - 1st project: Chiang Mai University

- Partnership with Thai Govt & BCPG
- First project P2P + VPP at Chiang Mai Uni
- 12MW solar installed at the Smart Campus



KEPCO Japan: P2P + REC Trading

- Successfully completed P2P trading for post-FIT surplus power in Osaka.
- Create, track, trade and provide settlement of RECs via platform.
- Settlement of Non-Fossil Value (NFV) certificates, generated by rooftop solar systems.
- Framework for KEPCO to provide RECs to RE100 customers.



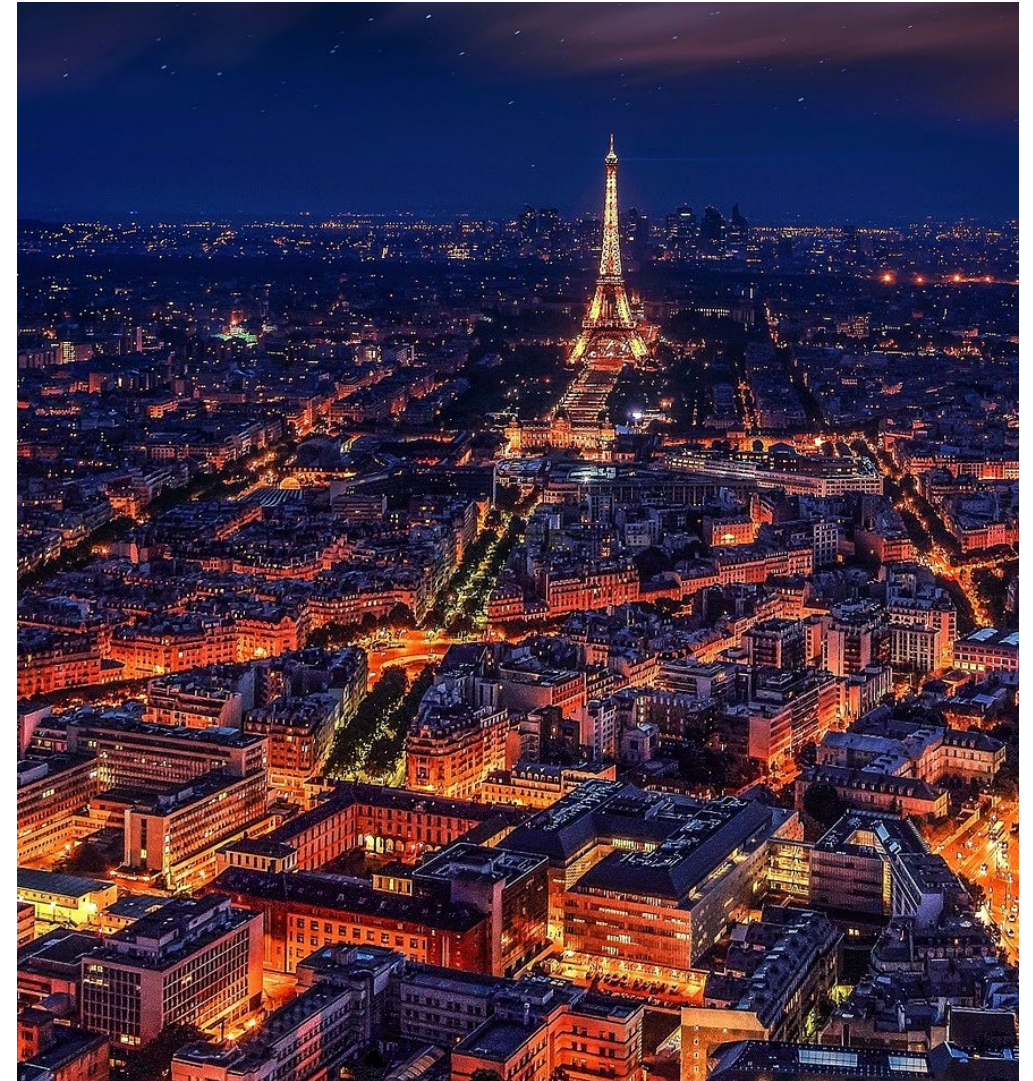
ISGF, Uttar Pradesh

- **Working with UPPCL and UPNEDA to deliver P2P trading in India.**
- **UPERC endorsed, govt is 1st in world to formally recognize blockchain as a mechanism to make energy markets more efficient.**
- **This partnership expected to formulate appropriate regulations to promote P2P trading of solar energy in the biggest state in India.**



ekWateur, France

- Launching a new product to 220,000 electricity meters across France.
- World's first application of blockchain to allow customers to 'choose their energy mix' based on the type of renewable energy, location and size of the generation (rooftop PV or large generation).
- The choices they make will contribute to the reduction of their carbon footprint.



Silicon Valley Power, California

- **Connected to the second largest EV charging station in California, which is powered by solar**
- **Power Ledger's platform automated the process to request LCFS credits are issued by CARB.**
- **Helps EV owners and charging stations to monetise their solar and batteries.**



Clearway Energy Group, California

- Partnership with renewable energy developer, owner and operator of 6GW, Clearway Energy Group, to develop a platform to trade Renewable Energy Certificates (RECs) in the United States
- Blockchain REC marketplace to drive cost efficiencies and improve market liquidity and transparency.



The RENeW Nexus Project – Fremantle, WA

- **Study of localised energy markets utilising blockchain technology. Supported by the Australian Government.**
- **In Fremantle, Western Australia, consisted of:**
 - **Freo 48:** Two-part solar P2P trading trials
 - **Loco 1:** VPP modelling
 - **Loco 2:** P2P + VPP energy trading



Image supplied by the City of Fremantle



Findings - RENeW Nexus

- **Energy trading popular with participants**
- **Energy trading altered energy consumption habits**



Image supplied by the City of Fremantle



Findings - RENeW Nexus

- **Energy trading popular with participants**
- **Energy trading altered energy consumption habits**



Image supplied by the City of Fremantle



**Using Power Ledger's P2P
and VPP software,
renewables can be scaled.**



PANEL DISCUSSION

Q&A



NEXT JOINT WEBINARS



Thirty innovations for a renewable-powered future

Wednesday, 26 August 2020 • 17:00 – 18:30 CEST

<https://www.irena.org/events/2020/Aug/Thirty-Innovations-for-a-Renewable-Powered-Future>



IRENA VIRTUAL EDITION INNOVATION WEEK 2020

Renewable solutions for transport and industry

5 - 8 October

<https://www.irena.org/events/2020/Oct/IRENA-Innovation-Week-2020>



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Innovations in electricity market design for solar and wind integration – Lessons learned from Europe

Tuesday, 20 October 2020 • 16:00 – 17:00 CEST

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