

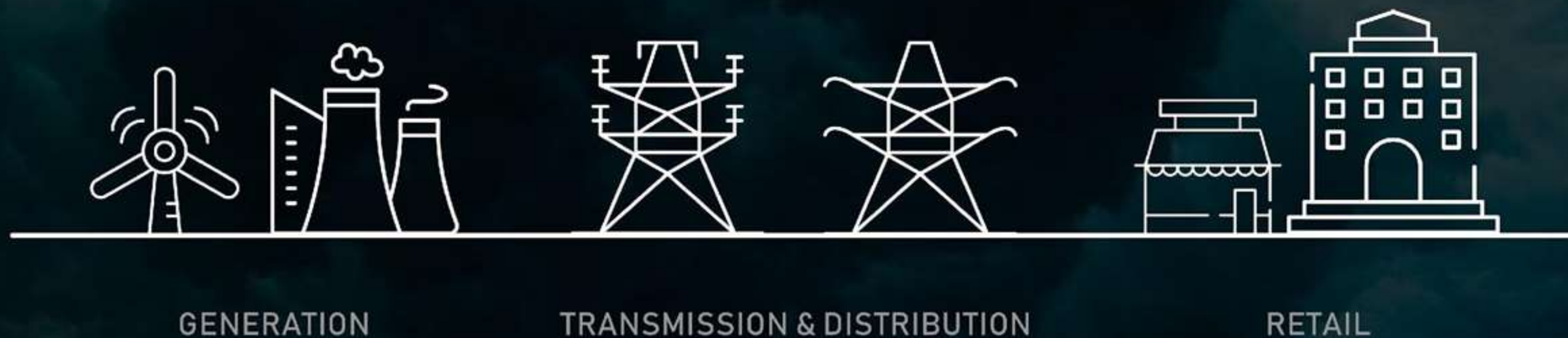


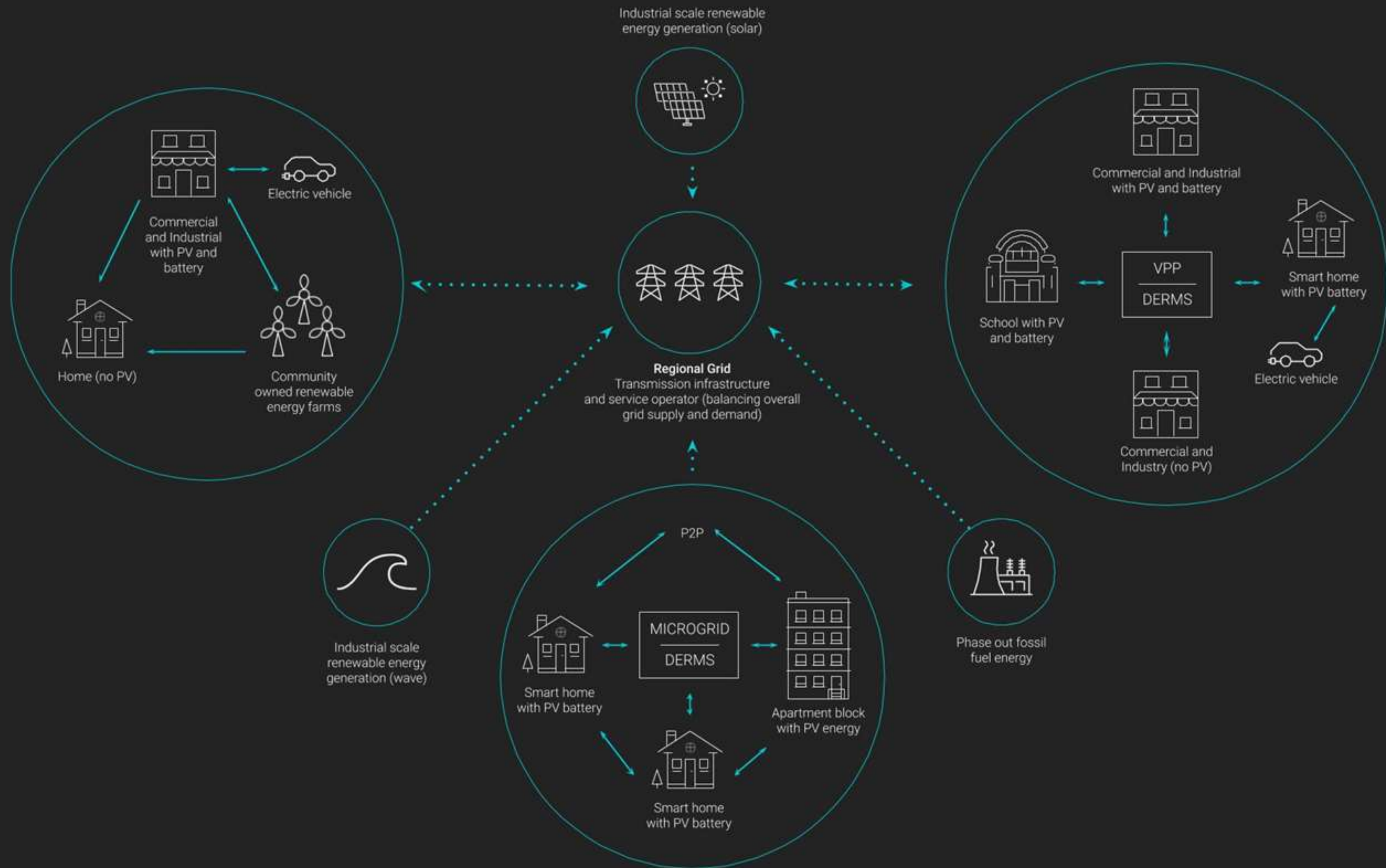
# Power Ledger

Energy, reimagined through Blockchain applications.

Vinod Tiwari  
Global Head of Business  
Development

# THE TRADITIONAL ENERGY INDUSTRY



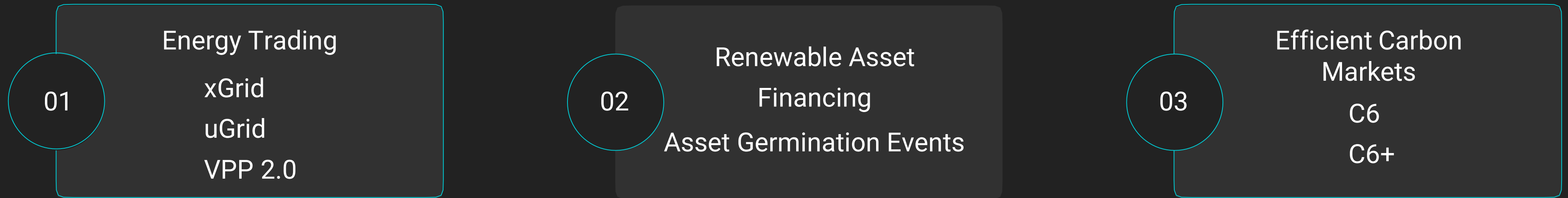


# THE ISSUES



# About Us

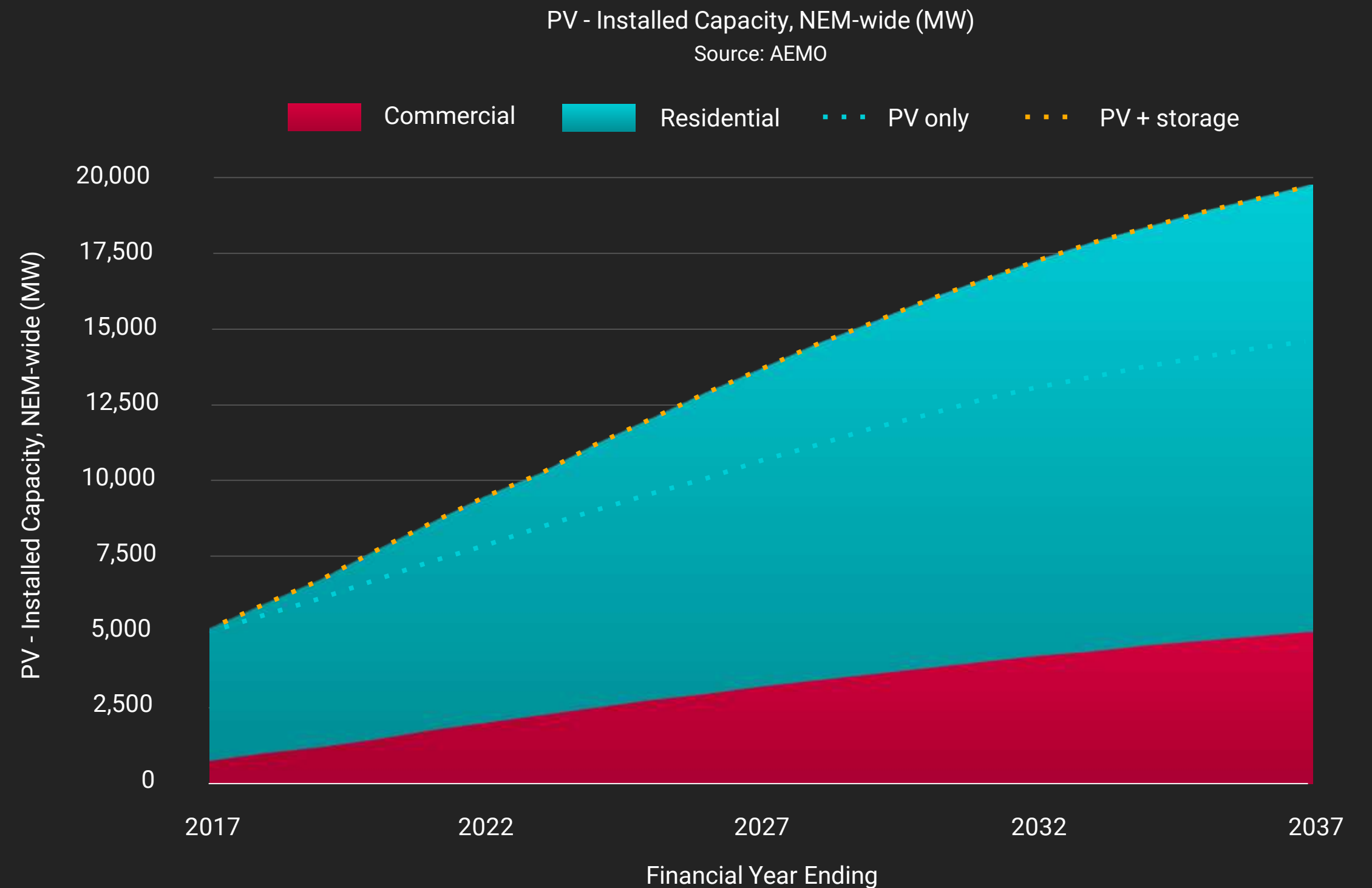
## Our blockchain technology enables three things...



# Solar PV Uptake

## Key Drivers

- Falling system costs make solar PV competitive with or without subsidies
- Increasingly more viable for SME and industrial customers
- Around half of mass market PV generation is exported to the grid
- Rapid uptake of rooftop PV continues to reduce peak demand and operational consumption
- Rooftop PV installations are forecast to grow at avg. annual rate of 8.7%



# Distributed Battery Uptake

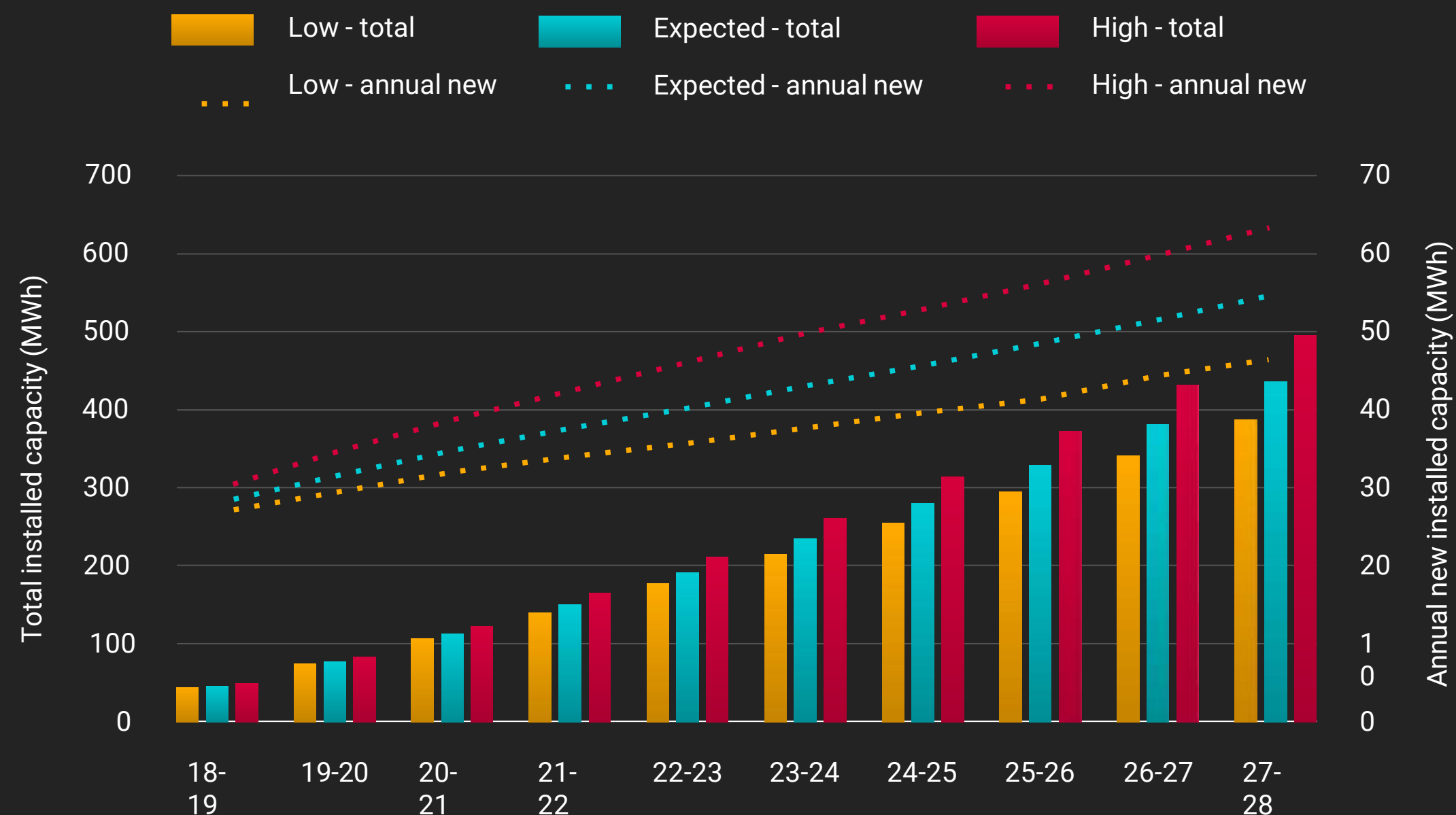
## Key Drivers

- Grid defection
- Regulations allow greater integration of storage into grid
- Li-ion price declines
- Price declines drive long-duration growth
- Utility-scale solar and storage
- Greater number of regions emerge
- Use of energy storage to defer transmission and distribution upgrades
- Revenue streams diversify

...Uptake has been under-forecast before.  
Should we be doing more to prepare?

Installed capacity of battery systems, 2018-19 to 2027-28 financial years

Source: ACIL Allen



# Grid Defection

---

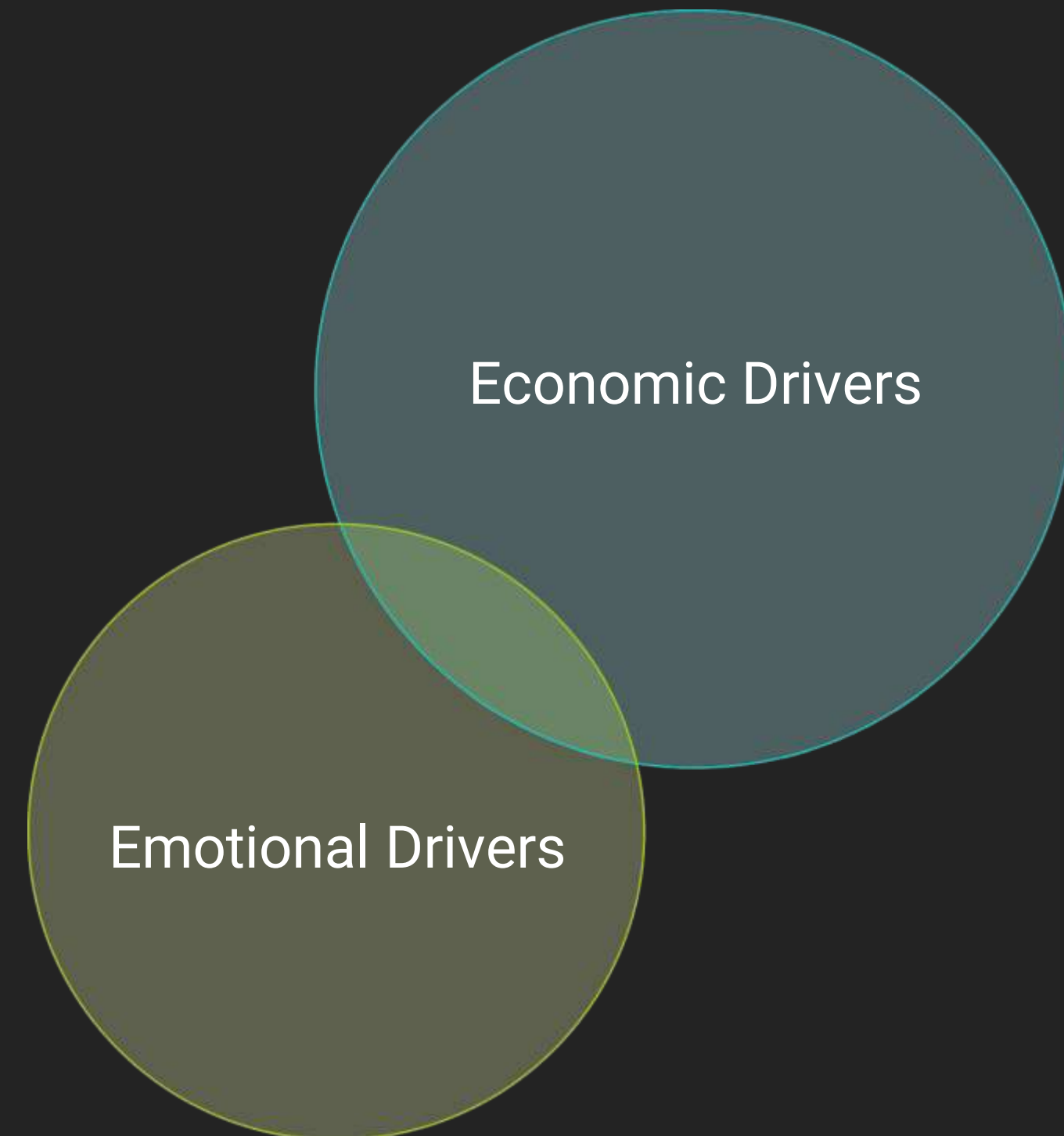
Grid defection is fundamentally driven by economics, but emotional drivers also come into play.

## Economic Drivers:

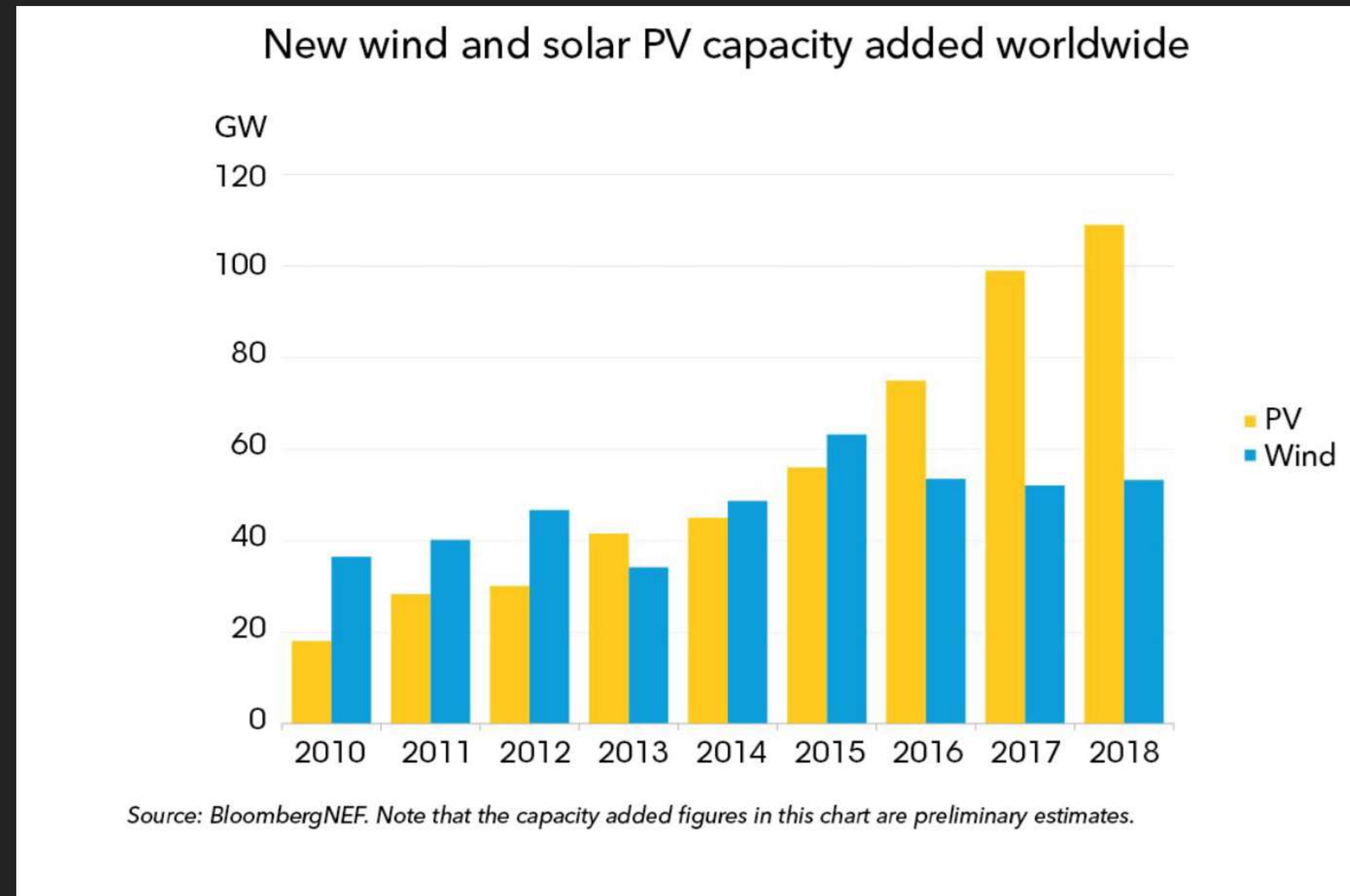
- Falling solar PV costs
- Decreasing export tariffs
- Increasing electricity prices

## Emotional Drivers:

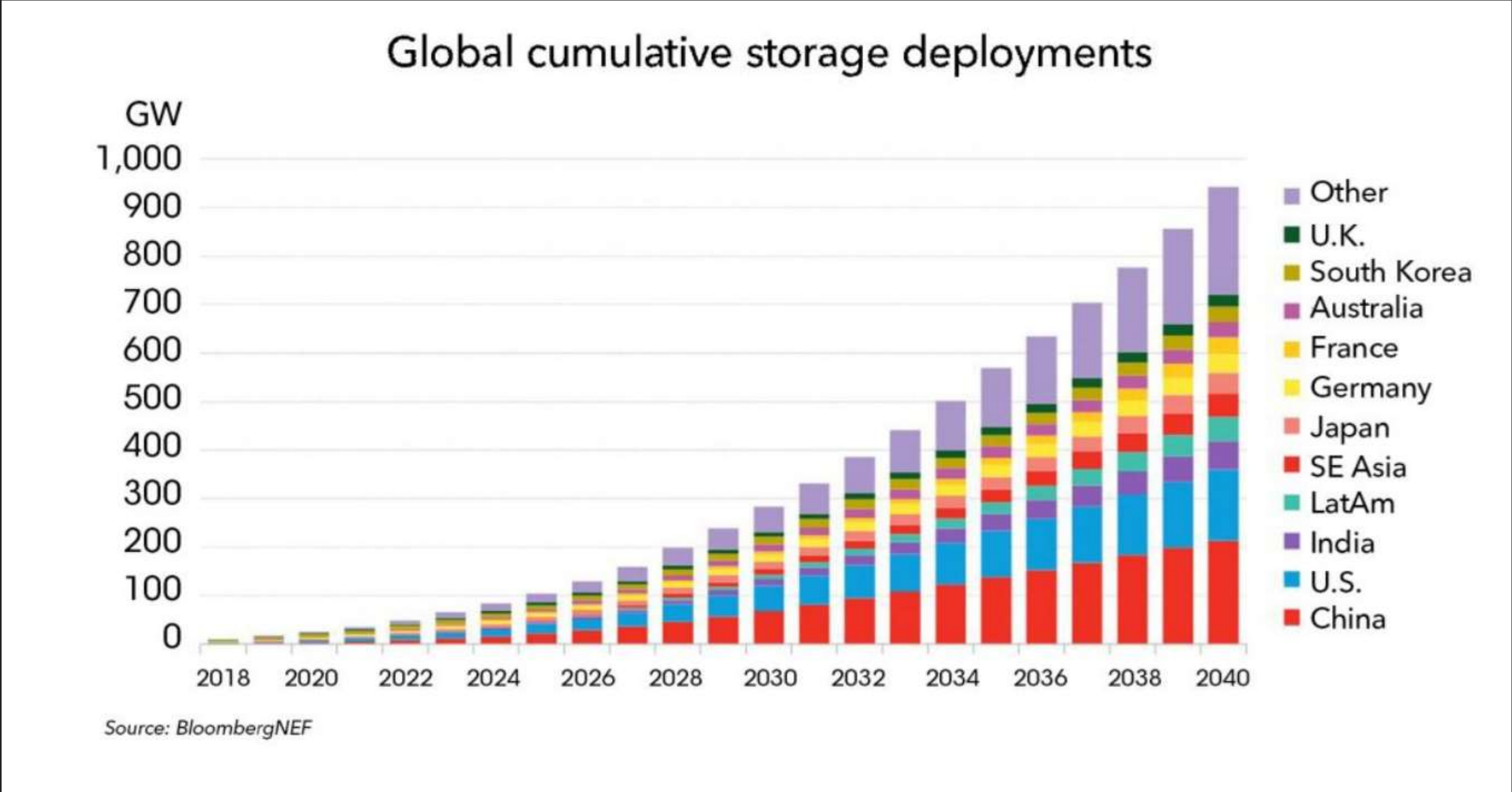
- Being more 'green'
- Greater autonomy
- Control over future energy costs



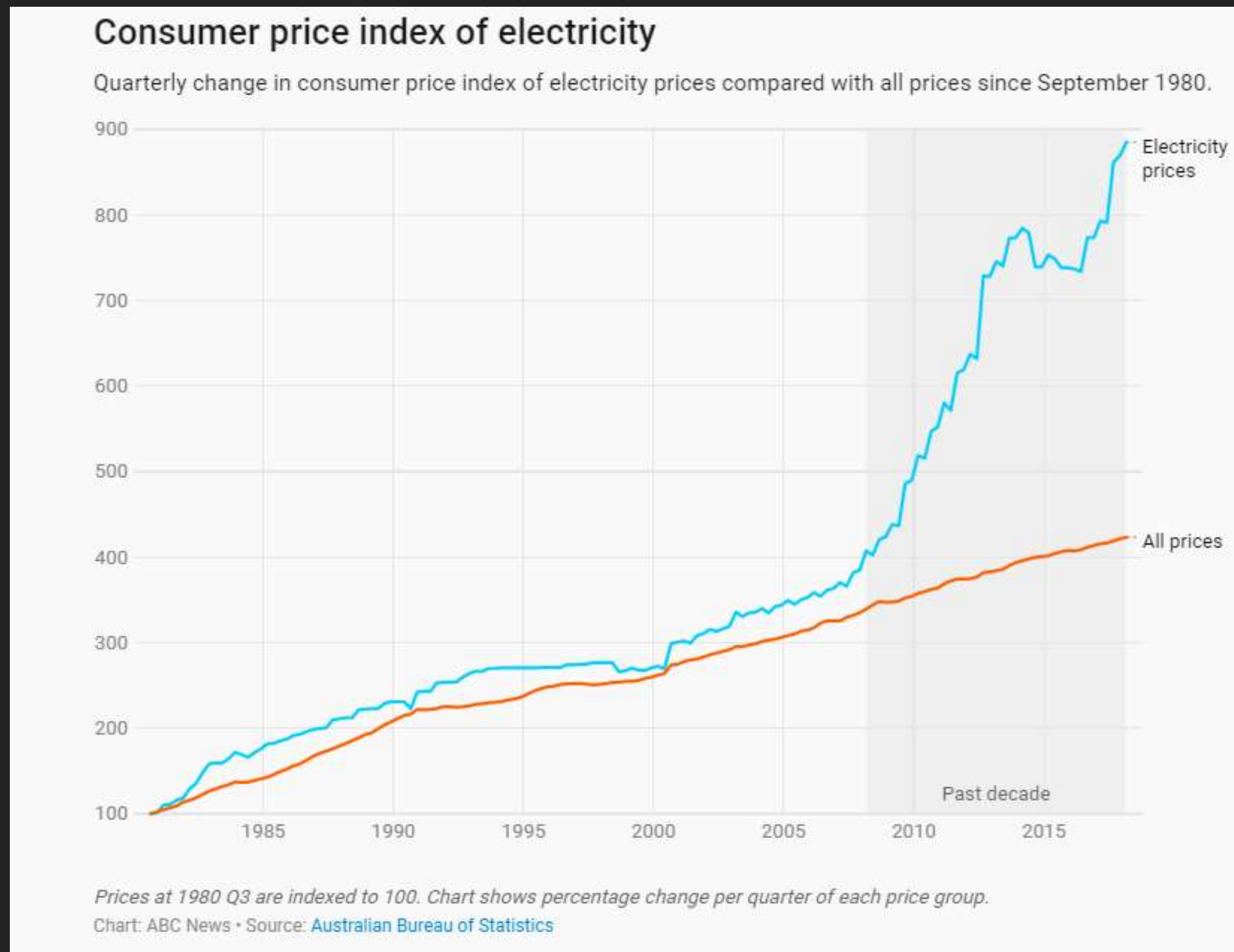
# New Global Wind and Solar Capacity



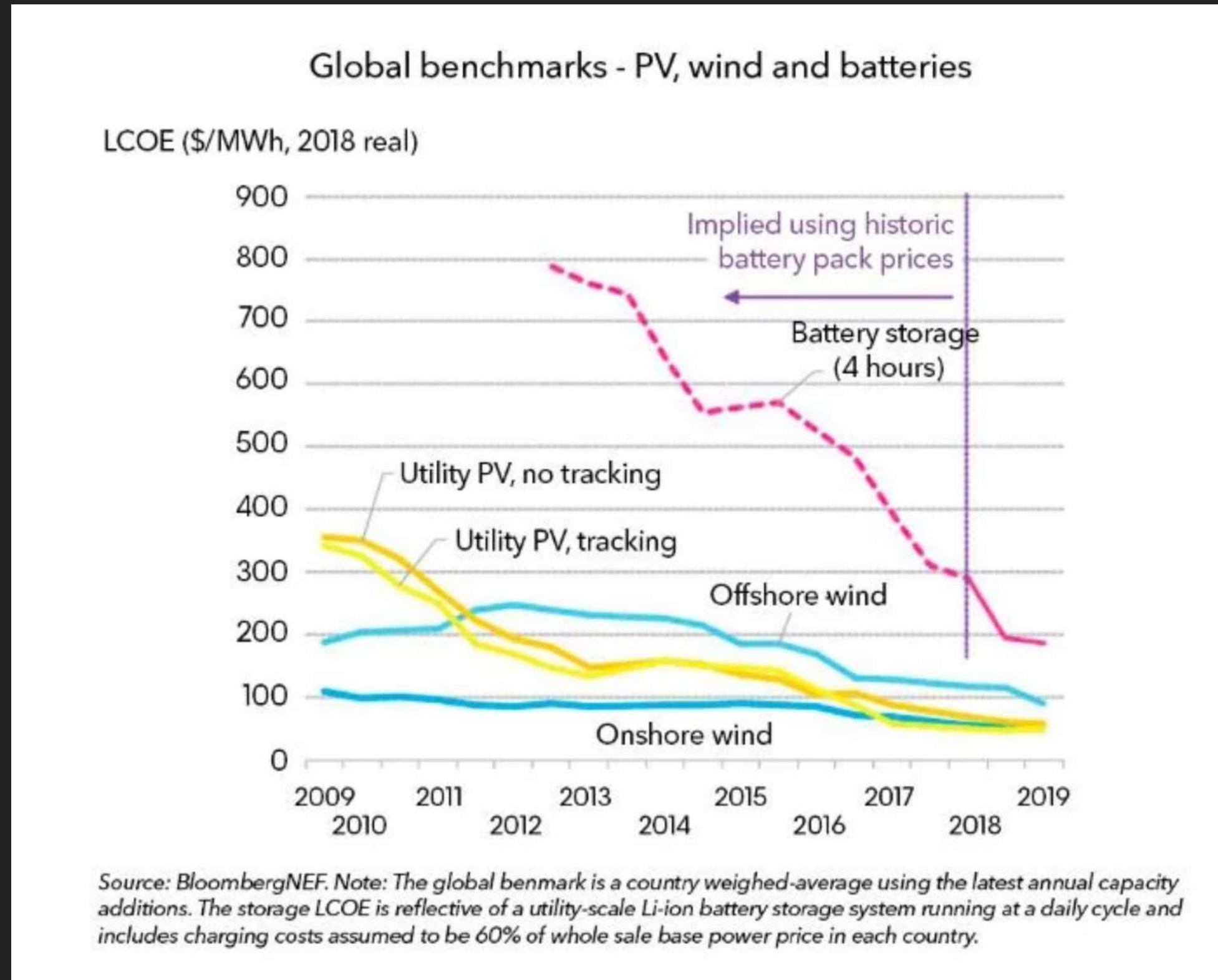
# Global Battery Storage Deployments



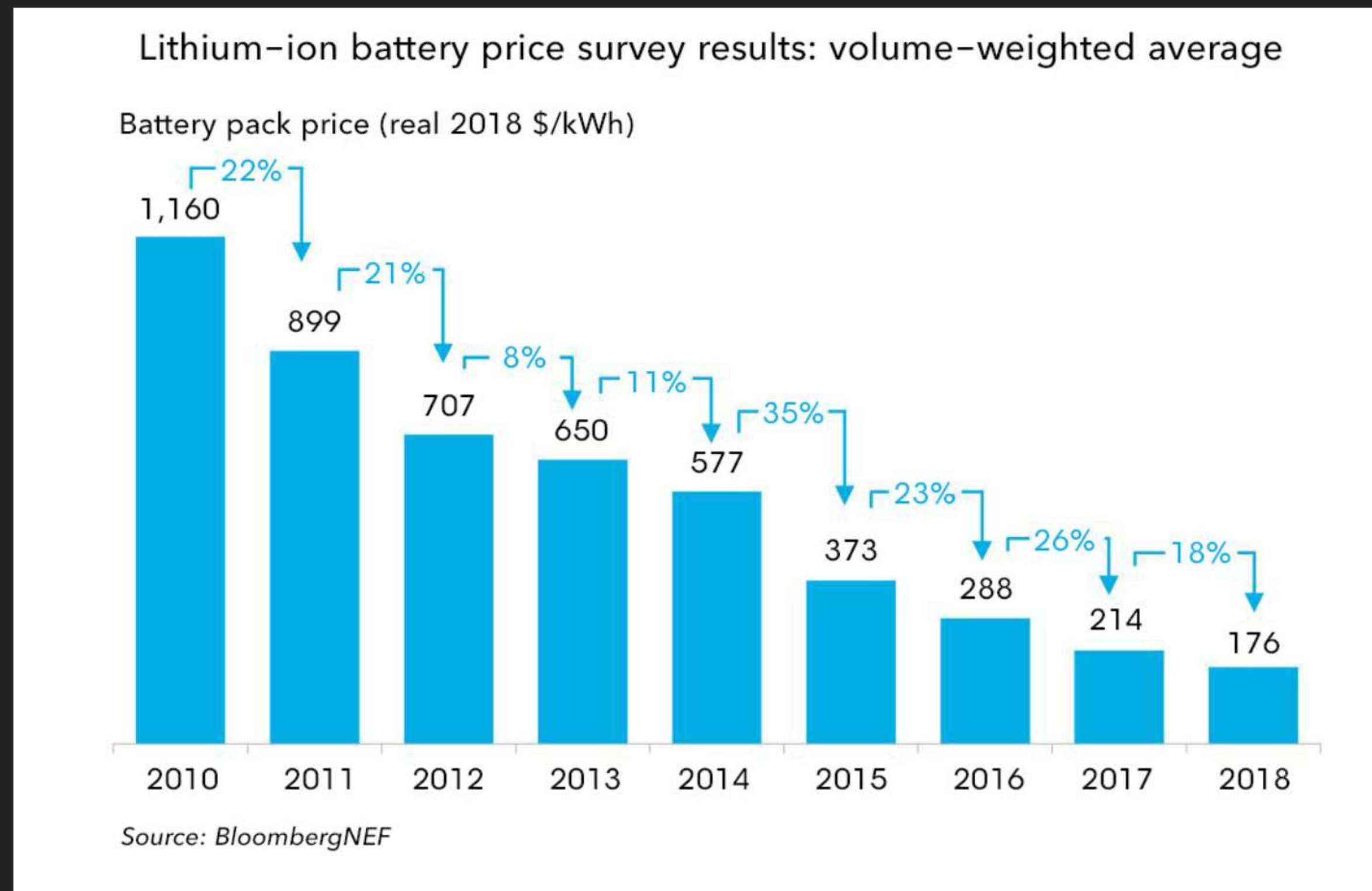
# Consumer Price Index vs Cost of Electricity



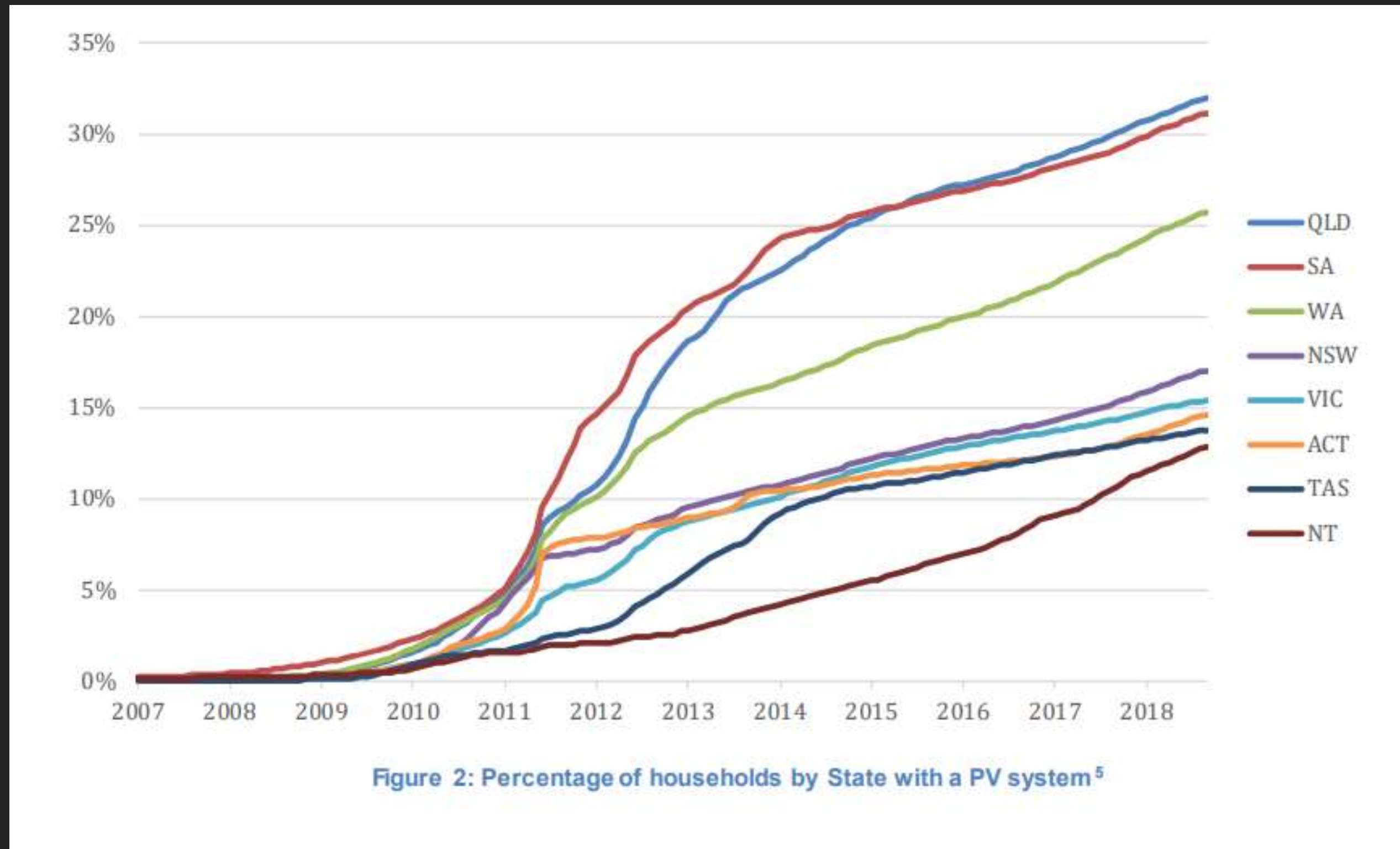
# The Cost of Clean Energy is Falling Worldwide



# Cost of Battery Storage is Falling



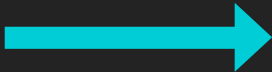
# Australian Homes with Solar PV



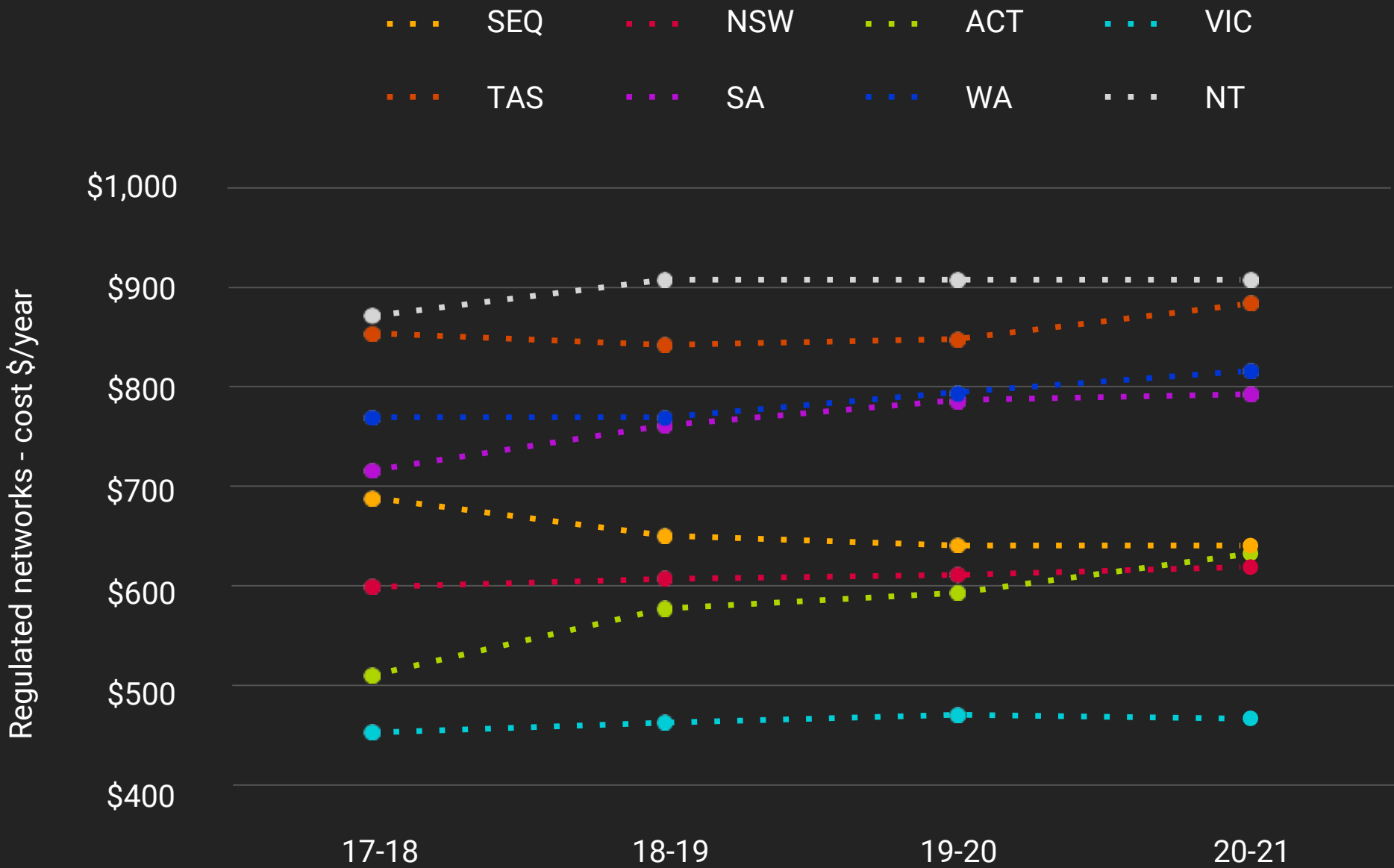
# Increase in Network Charges

Increase in network charges is linked to increase in uptake in PV.

State	% residential dwellings with PV installations
QLD	32.60%
SA	32.10%
WA	26.10%
NSW	17.80%
VIC	15.60%
ACT	14.20%
NT	14.20%
TAS	14.210%

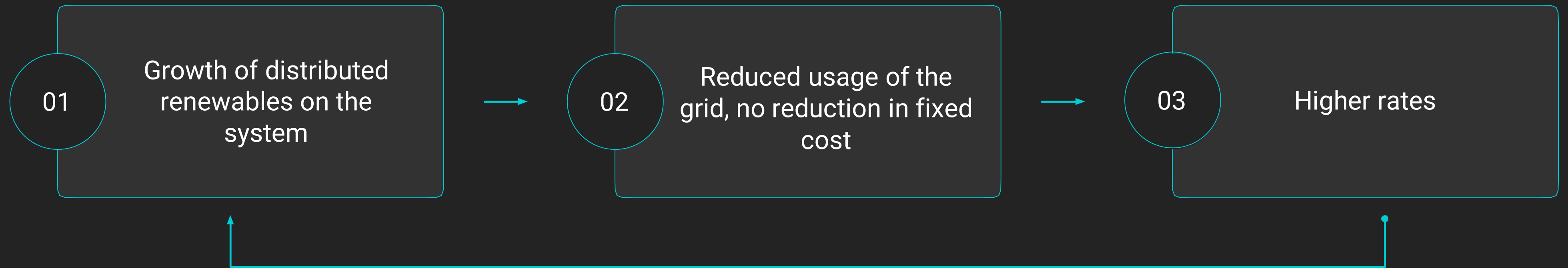


Network cost component of annual electricity bills for representative consumer  
Source: AEMC



# The Utility Death Spiral

---



We decided to develop a market-making technology that would help bridge the gaps in the system and make it more fluid and responsive.



# Blockchain Technology

---

- Removes friction and aides every part of the renewables market to...

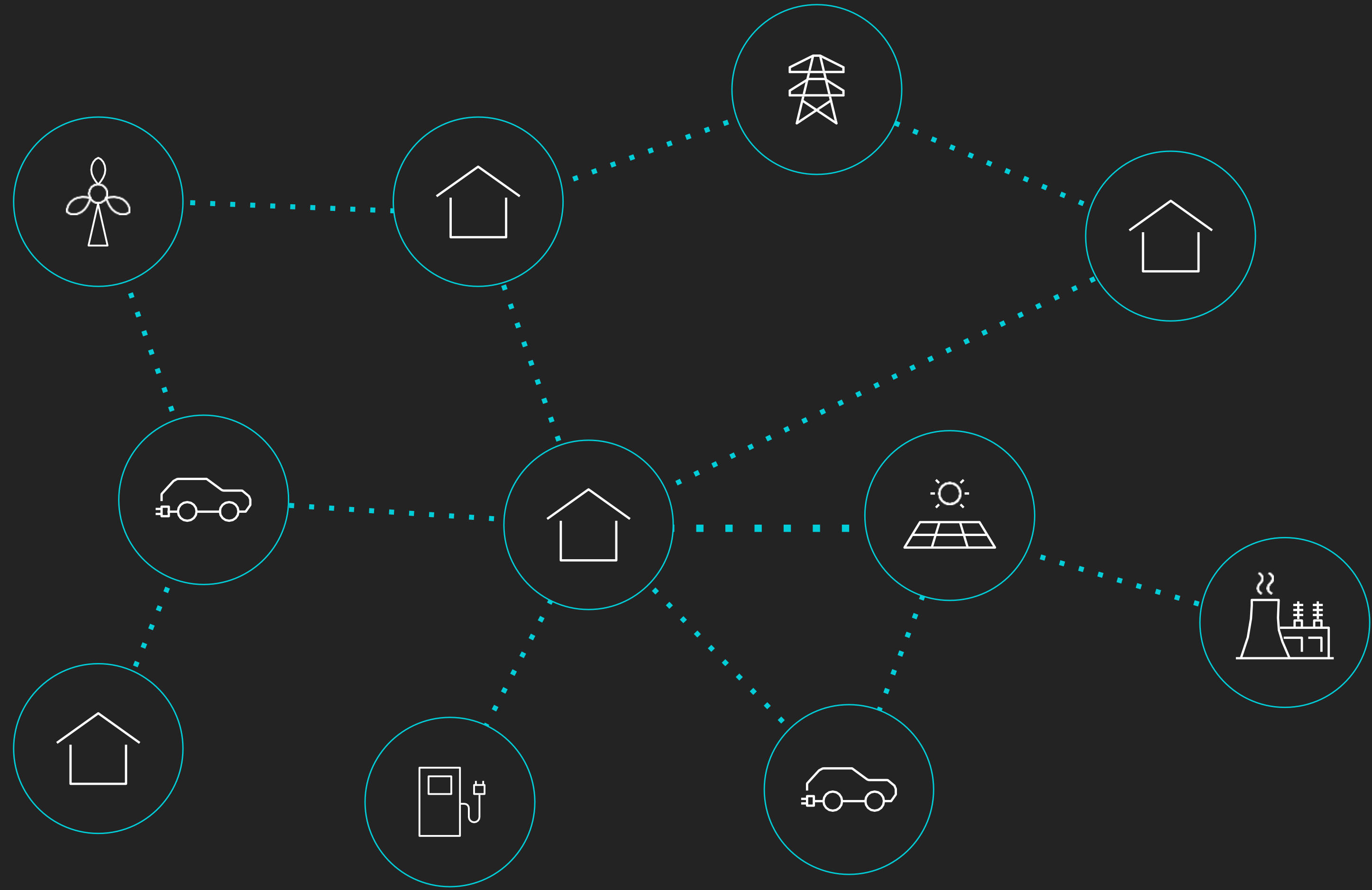
- 01 Trade energy easily
- 02 Invest in renewable assets
- 03 Make carbon markets easier



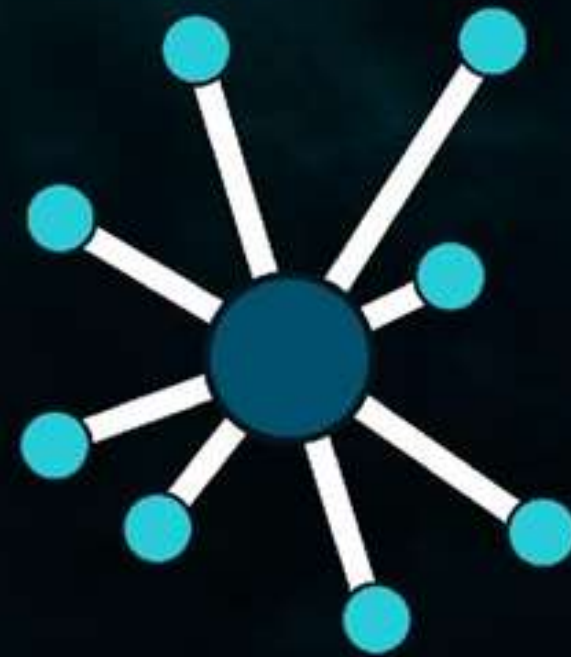
- Delivers traditional architectures...
  - Greater transparency
  - Immediate dividends
  - Increased automation
  - Streamlines price discovery
  - Eliminates risk of human error

This is what a decentralized electricity system looks like...

- Consumers empowered
- Clean
- Resilient
- Affordable
- Value creation for all players

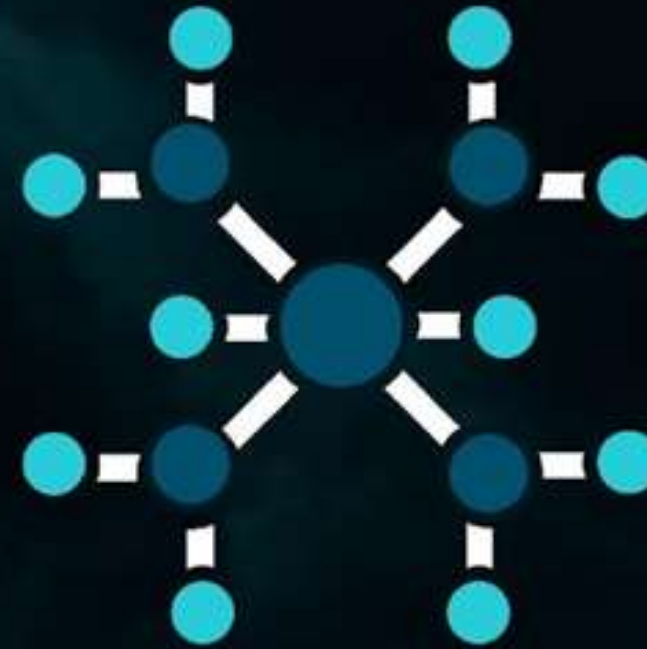


## DISTRIBUTED MODEL



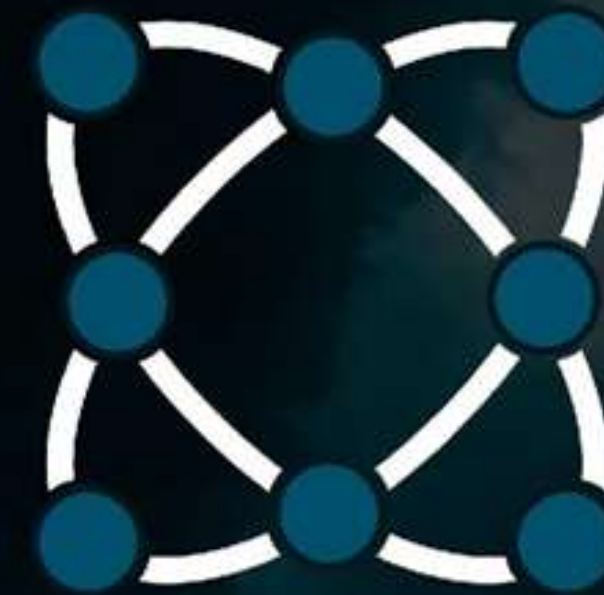
...

CENTRALIZED



...

DECENTRALIZED



...

DISTRIBUTED

Clean

Resilient

Affordable

Consumers empowered

Value creation for all players

# How we use the blockchain

Token creation and value transfer

Energy buy and sell

RECs/ Carbon credits

Asset tokens

Blockchain and smart contracts

Smart meter data

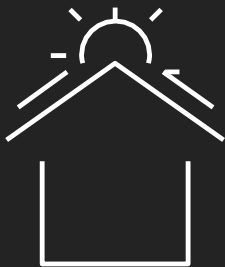
Energy trading

Carbon trading

Asset Germination



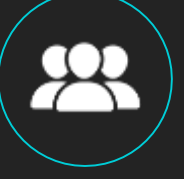
+ -  
+ -



+ -  
+ -



+ -  
+ -

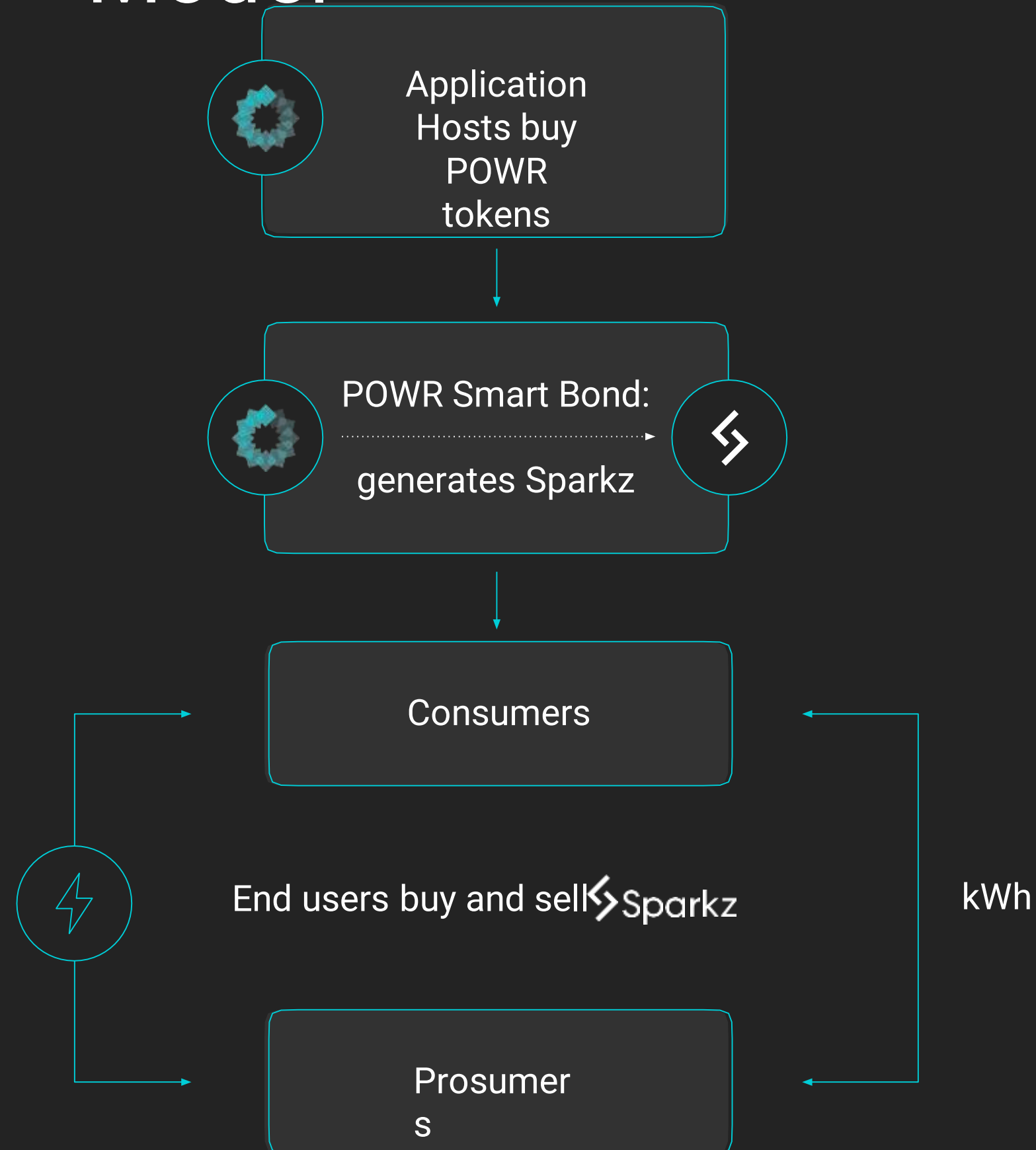


Income streams

Income streams

Fractionalisation of ownership

# The Dual Token Model



# μGrid

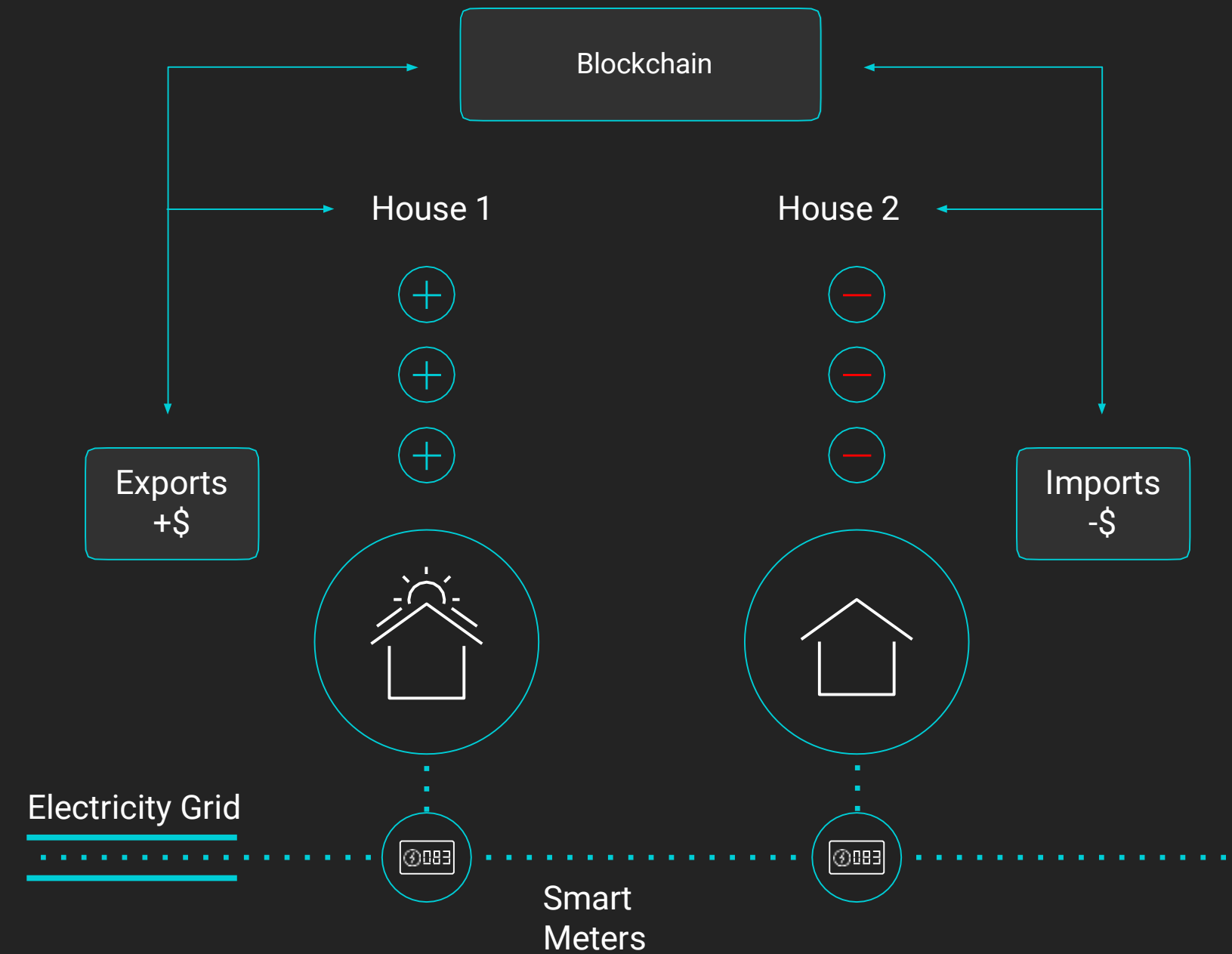
Peer-to-peer electricity trading behind the electricity mastermeter (microgrids).

## BENEFITS

- Tenants access cheaper, greener electricity
- Can be implemented on greenfield and brownfield developments
- Improved visibility over energy consumption
- Potential revenue stream for building managers
- Improves sustainability of development

## FEATURES

- Real-time settlement
- Detailed billing and usage data
- Automatically converts electricity credits to fiat currency
- Transactions viewable on the blockchain



# xGrid

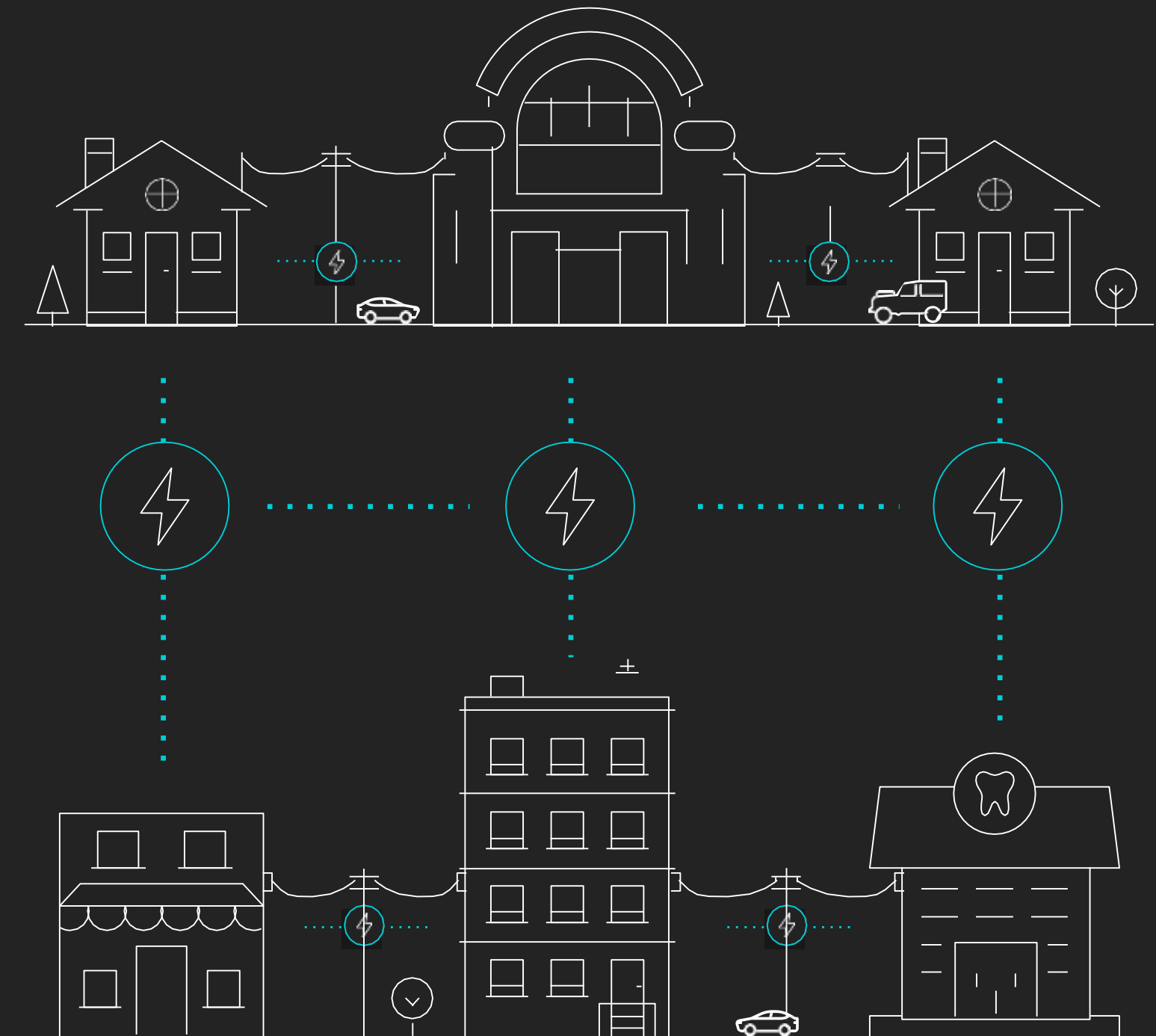
Peer-to-peer electricity trading across the regulated electricity network.

## BENEFITS

- Competitive advantage for innovative retailers to obtain and retain customers
- Enables more customers to access low-carbon energy
- More competitive electricity prices for consumers
- Better returns for customers generating excess energy
- Supports overarching energy system

## FEATURES

- Real-time settlement
- Detailed billing and usage data
- Automatically converts electricity credits to fiat currency
- Transactions viewable on the blockchain



# VPP 2.0

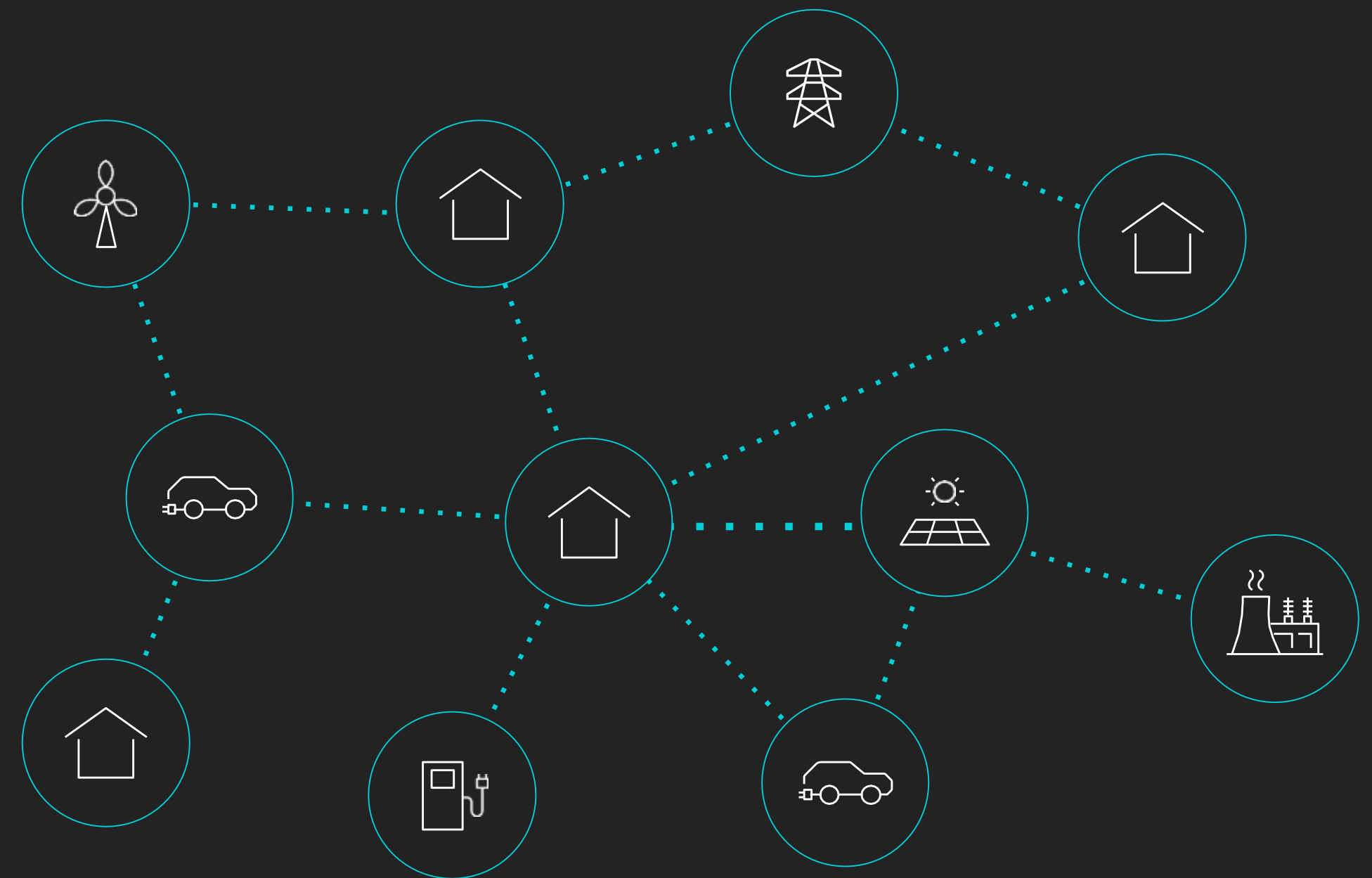
Enables energy companies to automatically manage supply and demand.

## BENEFITS

- Reduces risk and cost for energy retailer
- Consumers contribute to solving price spikes and demand shortages
- Households with solar and batteries can sell frequency, capacity and ancillary services to their energy company
- Faster payback period for household on their battery
- Daily settlement

## FEATURES

- Automatically manages supply and demand
- Real-time capacity management and load shaping
- Optimization of uses for highest value



# Singularity of Purpose

Virtual Power Plant's have been proposed to achieve...

Energy arbitrage

Load shaping

Power quality management

Ancillary services

Black start capacity

Self-healing network services

# Optimization Opportunity

As the value of the mode of operation increases, the opportunity for deployment decreases.



Smart contracts – self-executing contracts for service allow transition between service modes.

# VPP 2.0 Benefits

01

Automatically manage  
supply and demand

02

Real-time capacity  
management and  
load shaping

03

Optimization of  
uses for highest  
value

04

Reduce risk and cost  
for energy retailer

05

Faster payback period  
for households on  
their battery

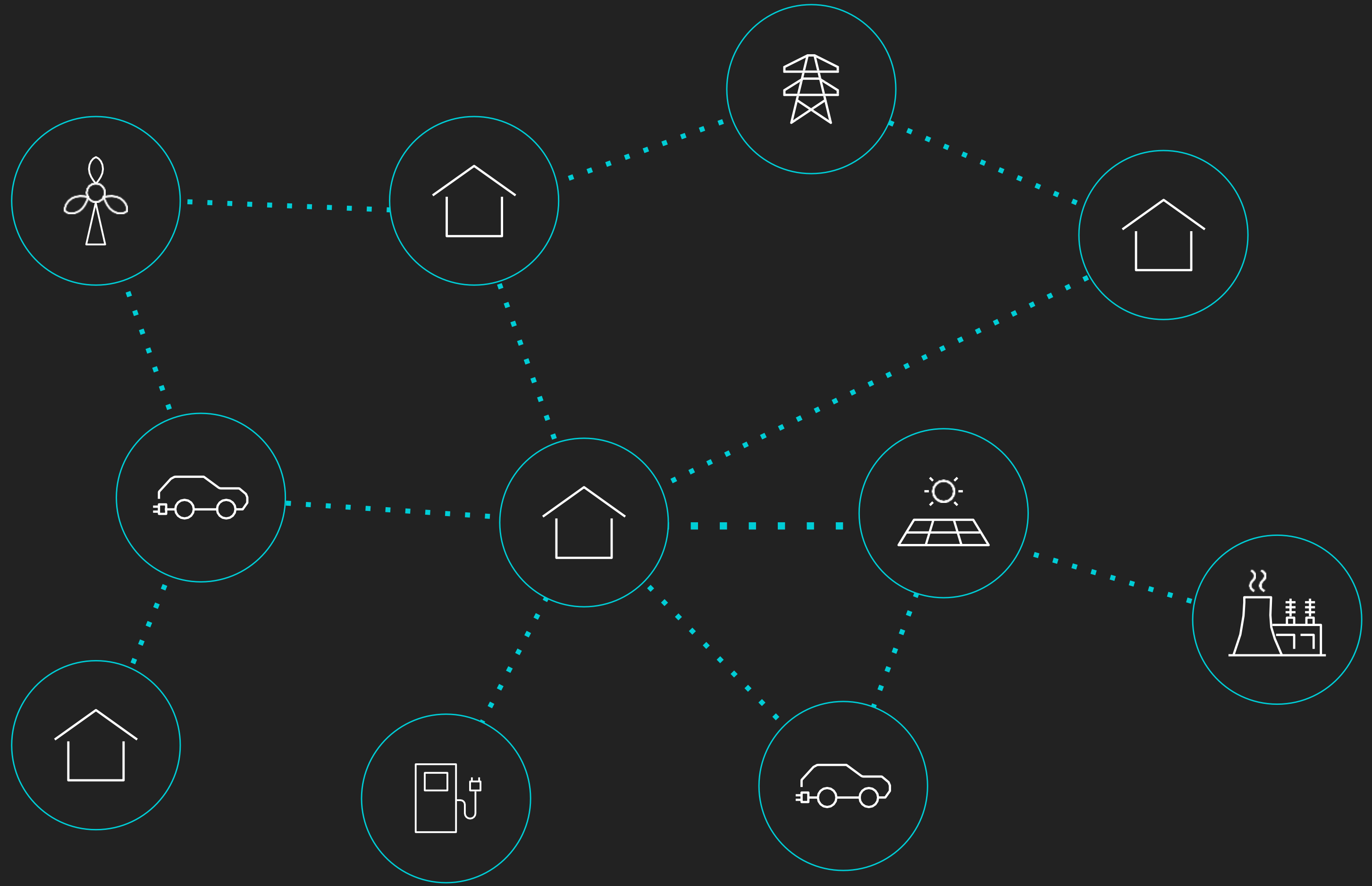
06

Minimize price  
spikes and number  
of blackouts

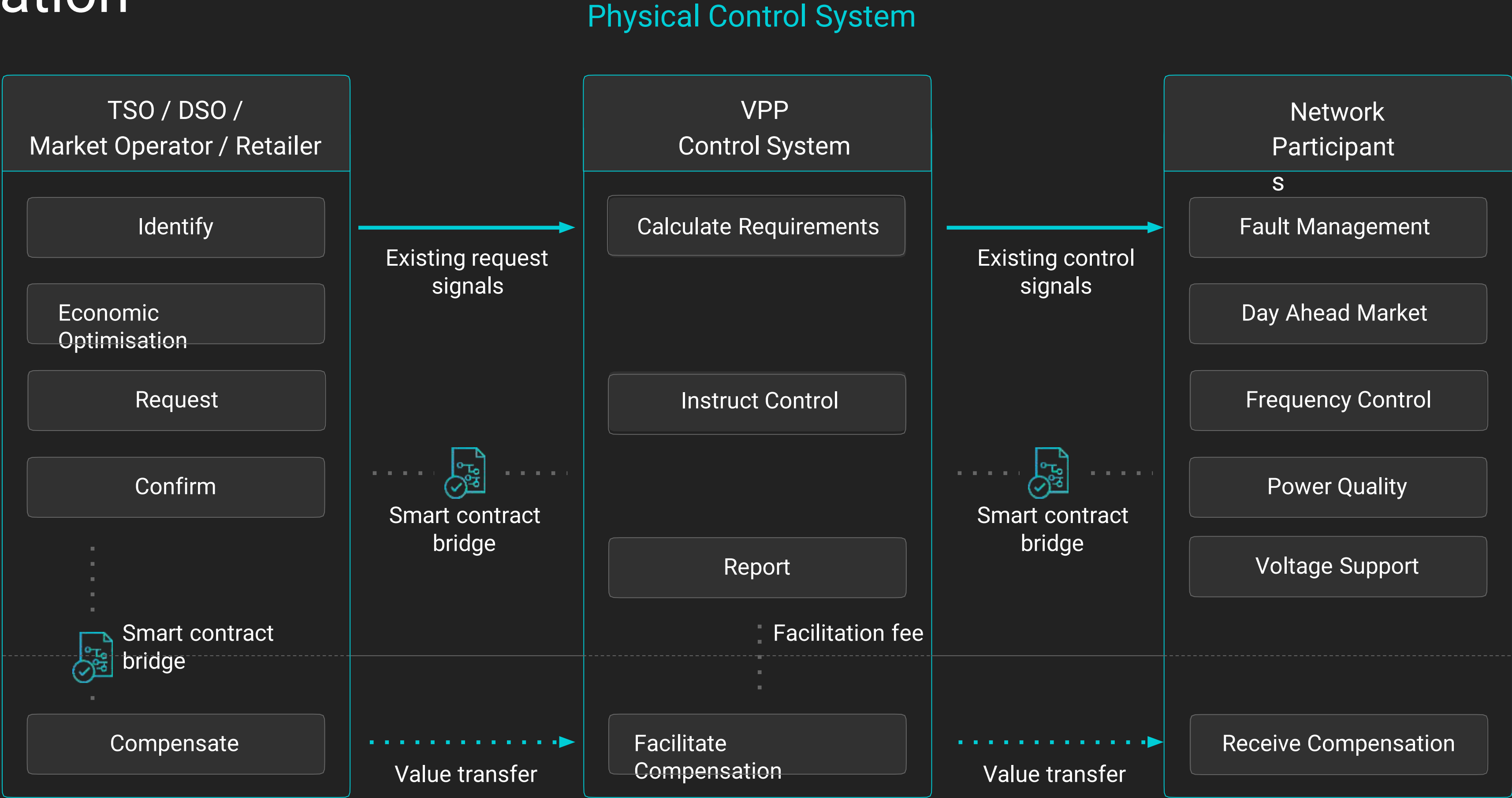


This is what a decentralized electricity system looks like...


- Consumers empowered
- Clean
- Resilient
- Affordable
- Value creation for all players



# Integration



- Energy Arbitrage - allows energy retailers to aggregate excess distributed capacity from batteries, providing a physical hedge against exposure to peak wholesale energy market prices
- Load Shaping - allows utilities to reduce the demand for electricity during peak usage times
- Power Quality Management - ensures a steady power supply that stays within the voltage and frequency range of the grid
- Ancillary Services - manages power system security by supporting the transmission of electricity from the point of generation to the consumer
- Network Control Services - controls active and reactive power flows to assist with maintaining power system security
- Black Start Capacity - enables the system to return from a blackout condition
- Self-healing Network Services - detects potential faults and power outages in real-time, using switches and controls to make adjustments and minimise the number of customers impacted



“Renewables need to be scaled up six times faster for the world to meet the Paris Agreement goals.”\*



# Asset Germination Events (AGE)

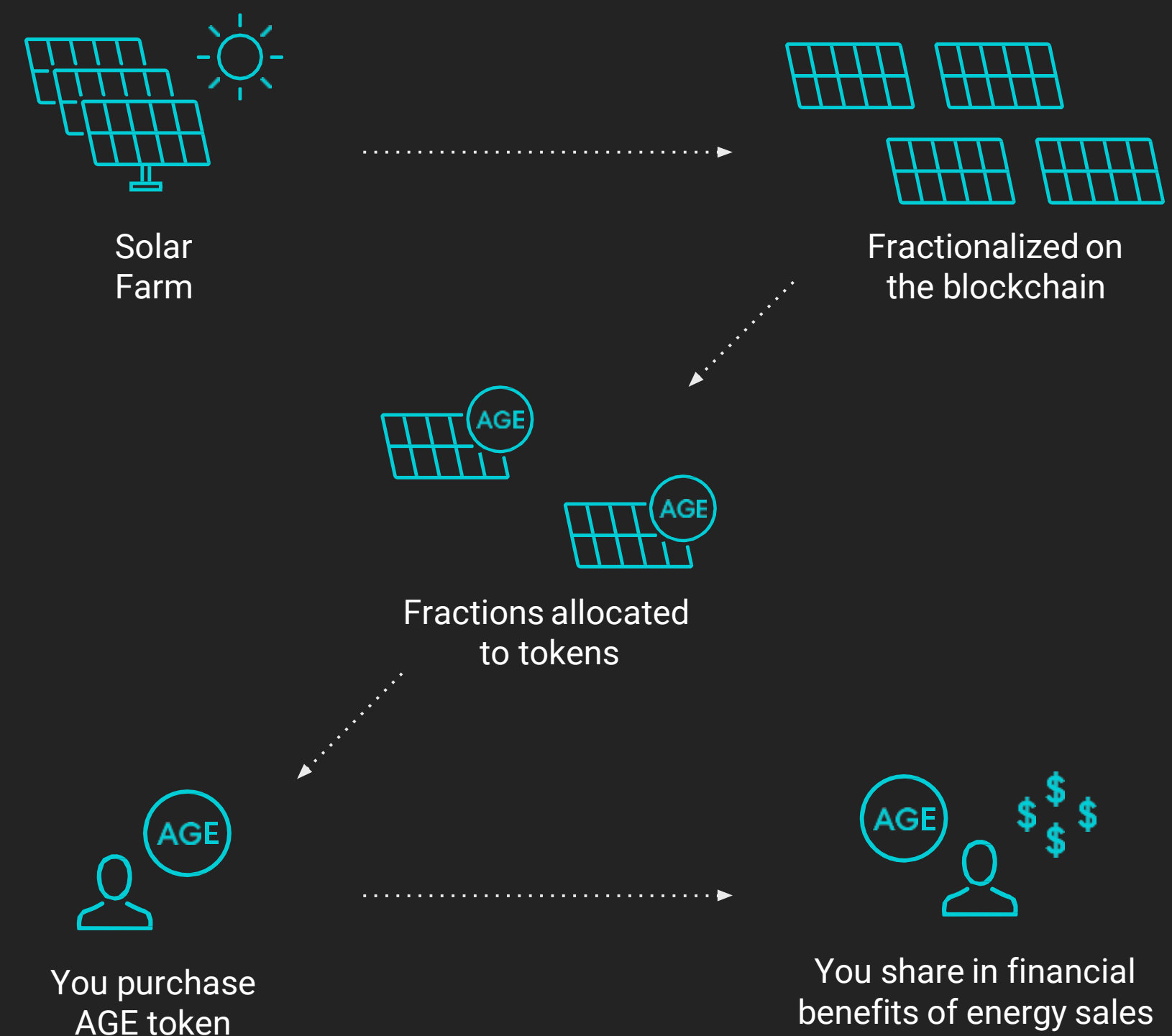
Allowing everyday investors to own a piece of tomorrow's energy systems.

## BENEFITS

- Supports uptake of clean energy
- Available to everyday retail investors, not just high net worth individuals
- Tradeable
- Reduces mistakes in asset registers and is more secure
- Diversifies cryptocurrency portfolios with a compliant, dividend-paying token

## FEATURES

- Security token developed with oversight from regulators
- Profits automatically distributed to token holders
- Exchange-tradable tokens
- Participants have legally enforceable rights to underlying assets



# C6 and C6+

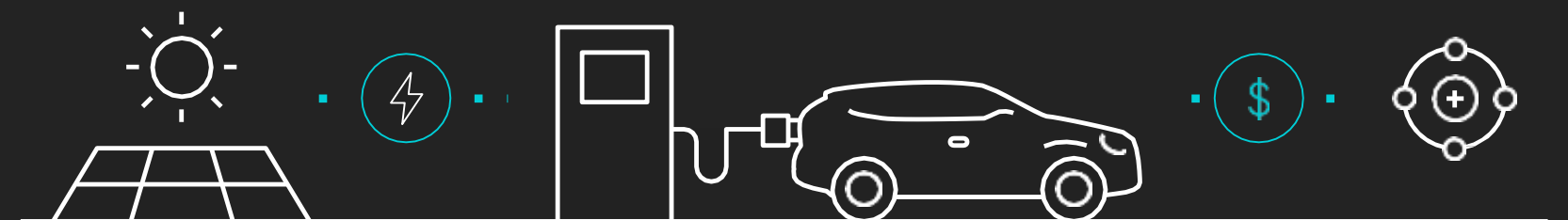
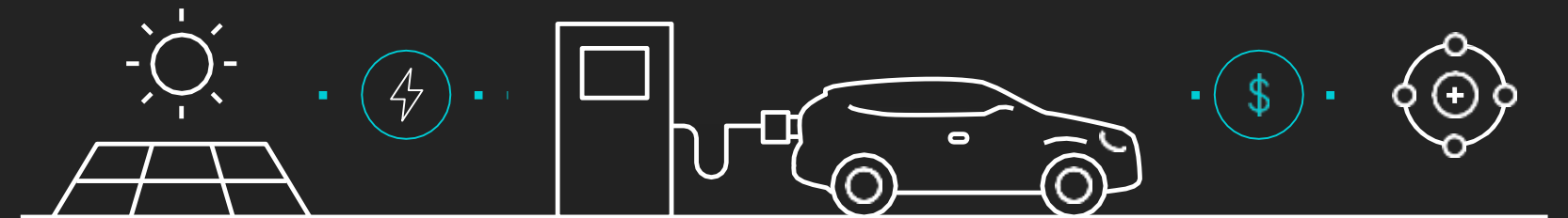
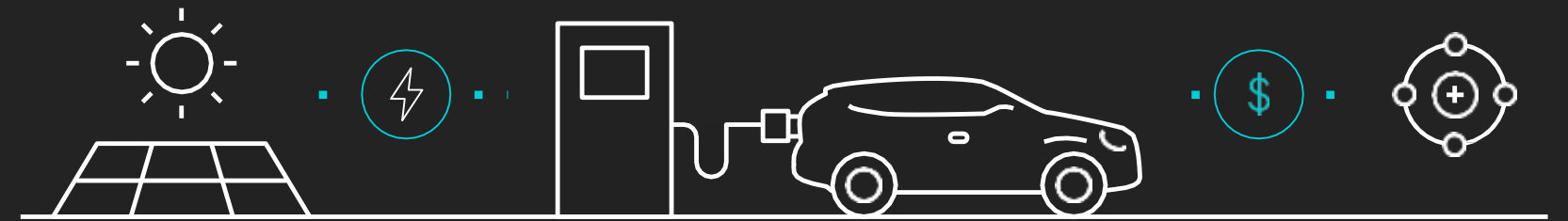
Monetize, trade carbon & renewable energy credits more efficiently.

## BENEFITS

- Improved ability to forecast and monetize future income
- Reduced barriers to claiming carbon & renewable energy credits
- Reduced burden of collecting and parsing data
- Transparent pricing for buyers and sellers
- Creates liquidity in carbon and renewable energy credit markets

## FEATURES

- Accurate measurement of energy generation (C6)
- Easily generates regulatory compliant reports (C6)
- Automates process to issue credits (C6)
- Enables credit trading in efficient, transparent, liquid market (C6+)
- Fast market settlement (C6+)
- Allows consumers to purchase and retire renewable energy credits via an exchange (C6+)



# Regulation

---

## ENERGY MARKETS

- Creation of local P2P markets to provide clear price signals for owners of distributed energy resources to stay connected and continue to provide energy back to the grid
- Markets need to provide financial recognition of the types of services DER can provide to the market

## NETWORK MANAGEMENT

- Current network charges are not designed to reflect the benefits that can arise from optimising locally generated renewable energy at the P2P level
- A category of network charges should take into account the reduced use of the transmission network and the more efficient utilisation of the distribution network

## ACCESS TO DATA

- Current rules make it difficult to access real-time data from smart meters required to maximise the benefits of innovative new technology like blockchain
- Direct access to this type of granular data will increase the security and accuracy of the PL platform

# BCPG Thailand

- 700kW solar trading across 6 commercial sites including a shopping centre, hospital, school and apartment buildings in the T77 Precinct in Bangkok
- In Q2 2019 4MW will be added to the platform and in Q3 a further 12MW
- Largest P2P trading project in the world



# Silicon Valley Power, USA

- Connected to the second largest EV charging station in California, which is powered by solar.
- Power Ledger's platform automates the process to request LCFS credits are issued by CARB.
- Helping renewable infrastructure owners to not leave any money on the table



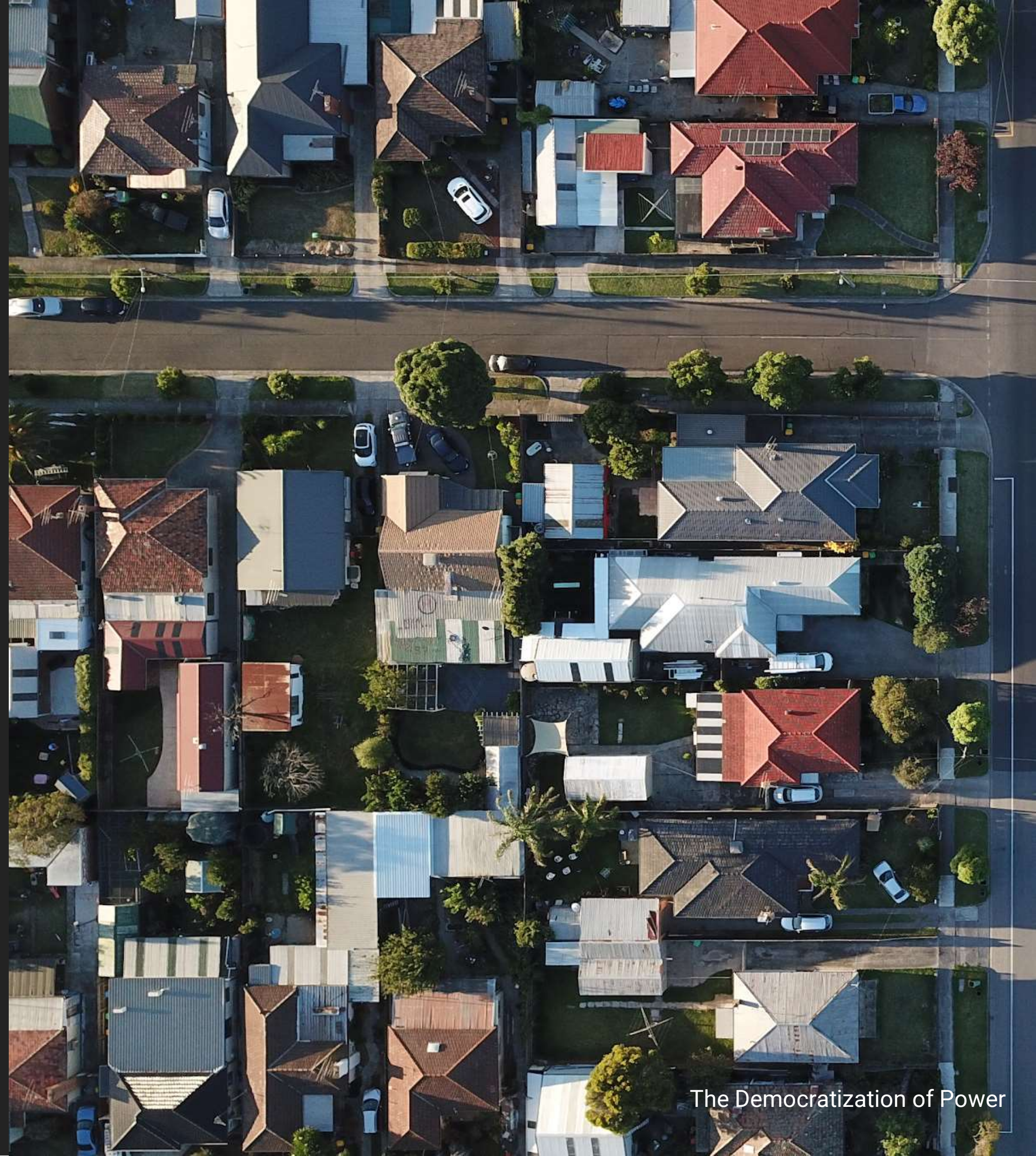
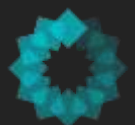
# KEPCO Japan

- Supporting the creation of a VPP in Osaka.
- Power Ledger's technology chosen to partner by KEPCO as a part of a competitive process.
- Large next project to be announced May 2019.



# Smart Cities & Suburbs: Fremantle, Australia

- Sponsored by the Australian Government.
- Live P2P trading in Fremantle.
- Project due to conclude June 2019 but Western Power & Synergy extending and expanding P2P to end 2019.
- Launched 670kWh battery in April 2019.



# Smart Cities & Suburbs: Fremantle

Dozens of new homes  
in Perth's south-west  
will be powered  
entirely by renewable  
energy.

Nine News Perth



# American PowerNet, USA

- Peer to peer trading across the largest US wholesale electricity market
- The technology utilizes existing distribution system and connected solar assets
- Uses data from pre-existing meters without the need for additional hardware, software or engineering fees
- The neighbors pay around 11% less for APN's excess solar energy



# American PowerNet

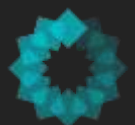
“Rather than just dump our excess solar power on to the grid, we’re thrilled we can now provide clean, sustainable power to our neighbors.”

President of American PowerNet Scott Helm



# White Gum Valley SHAC, GenY & Evermore

- Peer to peer energy trading multiplier residential establishments and community ownership of PV and battery at 24 apartments, and sustainable shared housing.
- Power Ledger's technology processes about 200-250 transactions every hour.
- About 80% of energy consumed is from renewable sources.
- Project partners include WA land developer LandCorp, Curtin University, Synergy and Australian Government Smart Cities Initiative.



Power Ledger



# White Gum Valley SHAC, GenY & Evermore

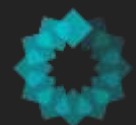
“This development provides not only vital housing, but also the ability to ensure that energy is both sustainable and affordable for our residents. We are delighted to have collaborated with Access Housing and Power Ledger on this development.”

Access Housing Chief Executive Officer Garry Ellender



# Energie Steiermark Austria

- Power Ledger and Austrian power utility Energie Steiermark AG subsidiary, ENext will use a peer-to-peer renewable energy trading network in the historic Austrian city of Graz.
- ENext customers will gain access to Power Ledger's energy trading platform.
- Initial trials involve 5 prosumers & 5 consumers in a sandbox environment.



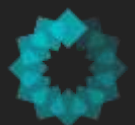
Power Ledger



The Democratization of Power

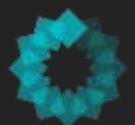
# Sustainable Energy Development Authority (SEDA Malaysia)

- Peer to peer energy (P2P) trading as national Sandbox Project with SEDA Malaysia with objectives to develop policy and business models on P2P as market based mechanism for acceleration in penetration of rooftop solar PV in Malaysia.



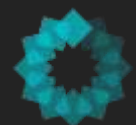
# Clearway Energy Group, USA

- Partnership with renewable energy developer, owner and operator of 5GW, Clearway Energy Group, to develop a platform to trade Renewable Energy Certificates (RECs) in the United States.
- This partnership will ensure a swift entry into the carbon trading market in the US, due to Clearway Energy's established footprint of renewable energy assets across 28 American states.



# Vicinity Shopping Centres, Australia

- Rooftop solar trading at Shopping Centres in Victoria and South Australia.
- Vicinity invested \$28 million in rooftop solar in South Australia and Western Australia alone.
- This project's renewable assets are set to be the largest Power Ledger has onboarded.
- The trial will begin at Roxburgh Village in Victoria and will be the first centre to integrate the energy blockchain technology as part of Vicinity's \$75 million industry-leading solar program.



# Vicinity Shopping Centres, Australia

“We see our partnership with Power Ledger as a significant opportunity to unlock a future of more competitive energy prices for our retailers and customers while potentially sharing clean, renewable energy to the communities surrounding our centres”

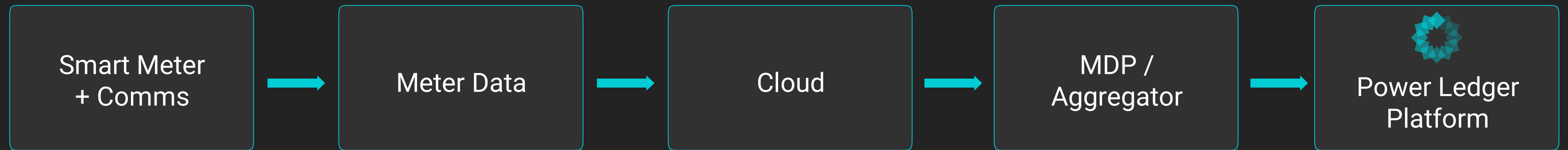
Executive General Manager,  
Shopping Centre Management Justin Mills





# Physical Requirements

---



# Key Staff

Our leadership and executive team have a broad range of Energy, Finance and Technology experiences which enables Power Ledger to develop tailored solutions and unique value propositions for businesses.



**Dr. Jemma Green**

Chairman and Co-founder

Setting her career trajectory early on, Dr Green became the voice of sustainability and corporate social responsibility in the business of big money lending while at J.P. Morgan in London. She then went on to complete a PhD in electricity market disruption and become a research fellow at Curtin University, was Deputy Lord Mayor of Perth, helped set up Australia's first fossil fuel free pension fund and has sat on numerous boards championing sustainable business such as the Water Corporation, Carbon Tracker and Climate-KIC Australia. In 2016 Jemma founded blockchain technology company Power Ledger and in 2018 received the EY Fintech Entrepreneur of the Year award.



**David Martin**

Co-founder & Director

David has nearly 20 years' experience in the electricity industry and has held executive positions in two state-owned electricity utilities. Prior to setting up Power Ledger in 2016, David spent six years as a senior consultant to industry participants specializing in regulation of distribution networks, consumer engagement, renewable/new technology feasibility studies and business development. David has significant experience in the challenges and opportunities facing regulated energy networks businesses as they transition to a new energy-demand paradigm that sees customer behaviour leading technology and service demand changes that can present "make or break" opportunities for energy markets.



**Maria Atkinson AM**

Advisor

Maria is an important advisor to Power Ledger. Maria is passionate about sustainability and works with the most senior people in Government and business globally to realise more sustainable practices and strategies. Maria is an expert in the realm of sustainability and are a highly sought after thought leader. Maria's experience spans stakeholder engagement, governance, strategy, organizational and market transformation, and business development. Maria has worked in most international markets and her sustainability and social responsibility credentials, gained in corporate, not-for-profit, professional and industry organisations, are widely recognised. Maria has been part of some of the most important conversations about how to build a sustainable future for companies and nations that have occurred in recent times. In recognition of her numerous contributions, Maria was awarded the Member of the General Division of the Order of Australia in 2012.



**John Bulich**

Technical Director and Co-founder

John provides the strategic direction for conceptual, system and application design and development for Power Ledger. John leads the technical team in the development of the Power Ledger platform. John cofounded Ledger Assets, and pioneered blockchain technology in Australia. Ledger Assets has successfully developed and deployed world-first blockchain-based products proving the provenance of artefacts including evidence-grade photography, video, document management and medical records management.



**Vinod Tiwari**

Head of Business Development and Sales

Vinod is leveraging his network from many years working within the Australian energy sector, previously as the COO of Regen Power, General Manager Sales at Perth Energy and Senior Advisor Future Effect, to connect with client stakeholders across power and business domains, as well as across various third party providers to support the delivery of Power Ledger's blockchain offering; building new propositions and enhance existing customer experiences. His past roles also include managing technical sales and business development teams for General Electric in India. Vinod holds an MBA from the University of Western Australia and a Bachelor of Electrical and Electronics Engineering.



Power Ledger

The Democratization of Power

# Power Ledger's vision: Democratisation of Power

---

To be a major contributor to transforming energy markets globally and the Paris Climate Goals, positively impacting 1 billion people.

The Democratization of  
Power



# Power Ledger

