



# La energía renovable - factor clave para la descarbonización de las economías

FISE-CIGRE CONFERENCE 2021

18 de noviembre de 2021

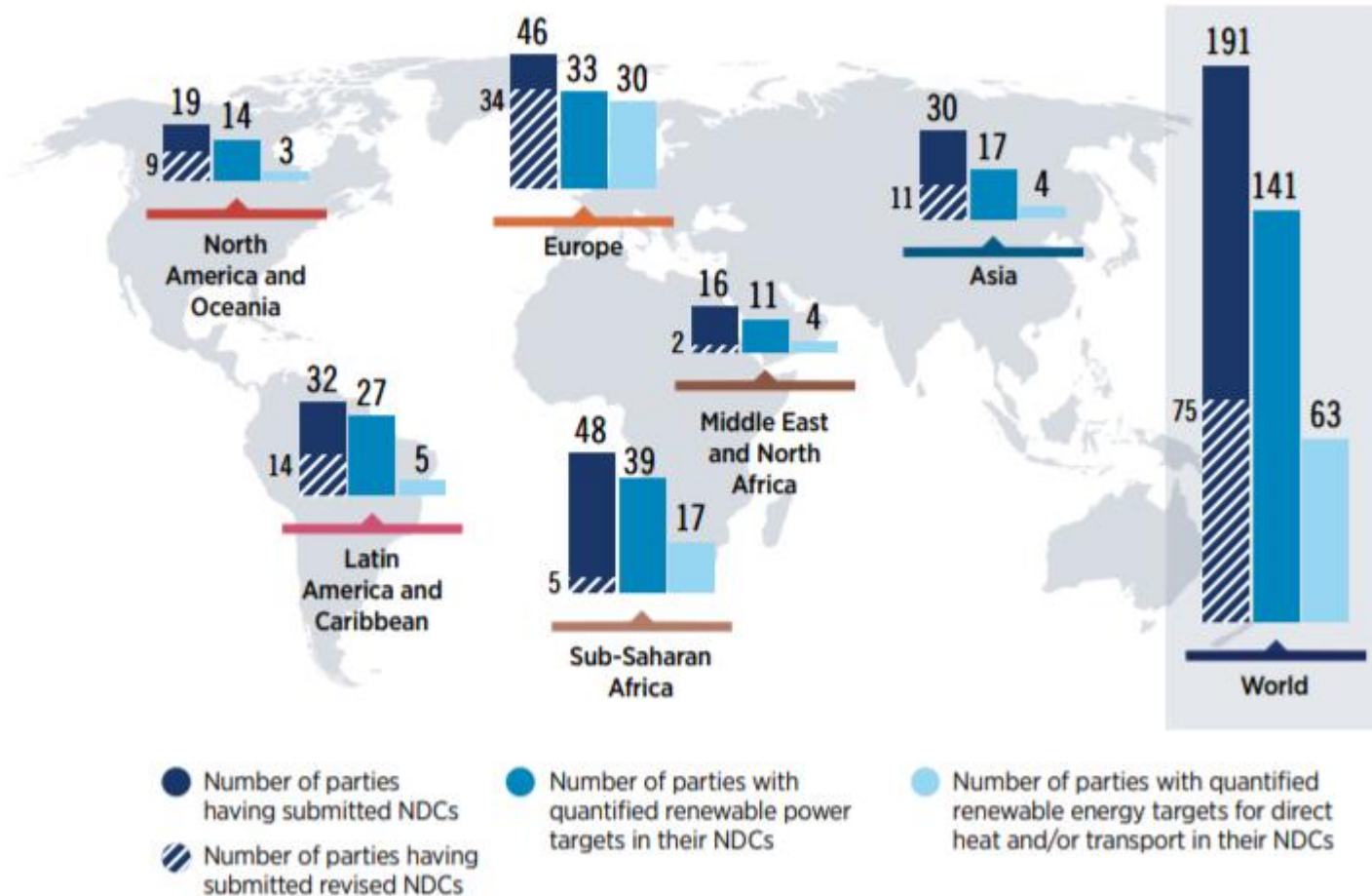
# Hacia sistemas energéticos más sostenibles y resilientes

---



**NDC implementation**

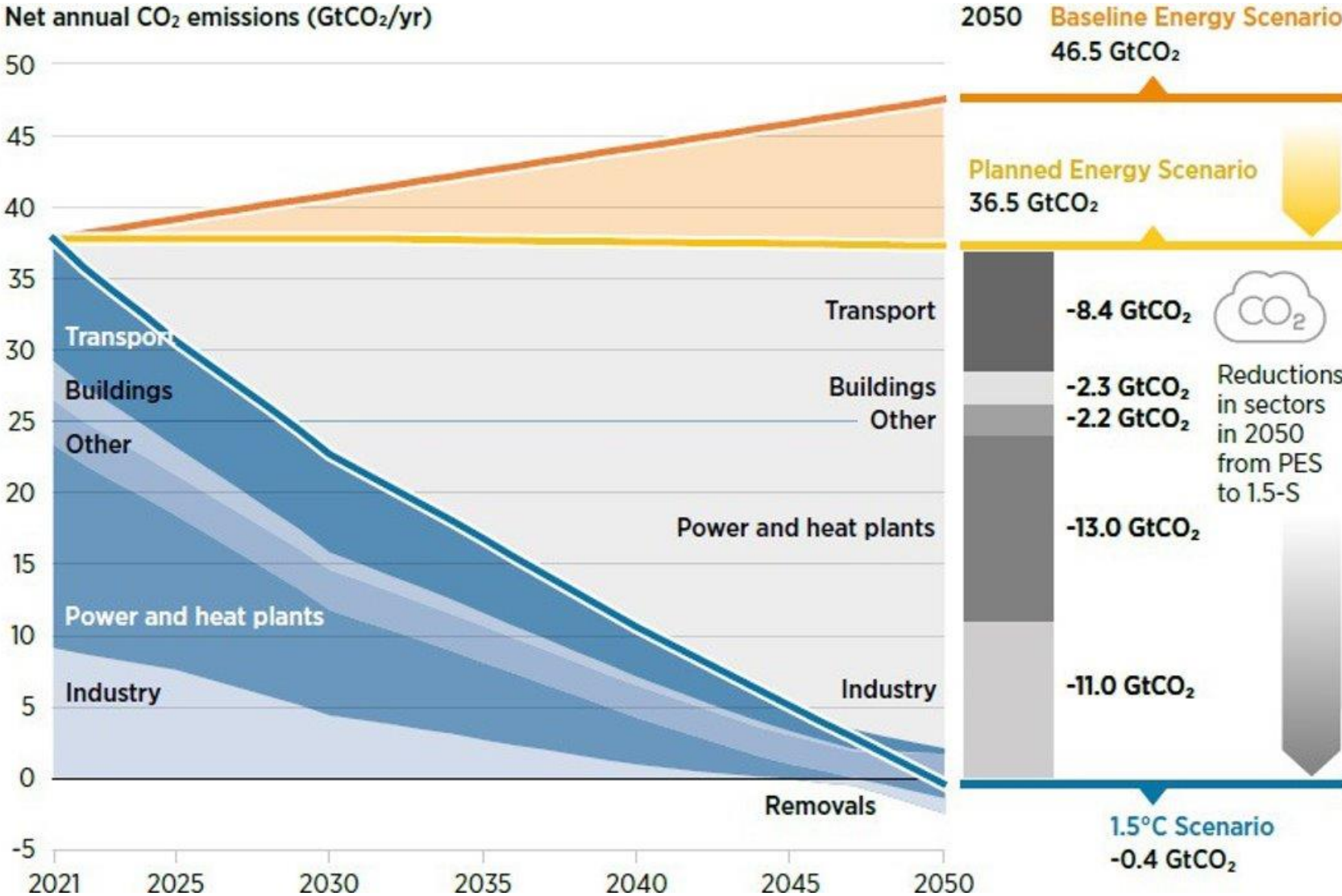
# El papel de las energías renovables en las Contribuciones Nacionales Determinadas (NDCs)



- Renewables are essential to achieve the Paris Agreement goals
- 141 parties (74% of total) have set out quantified renewable power targets in their NDCs
- 63 parties (33% of total) have set out quantified renewable energy targets for direct heat and/or transport in their NDCs

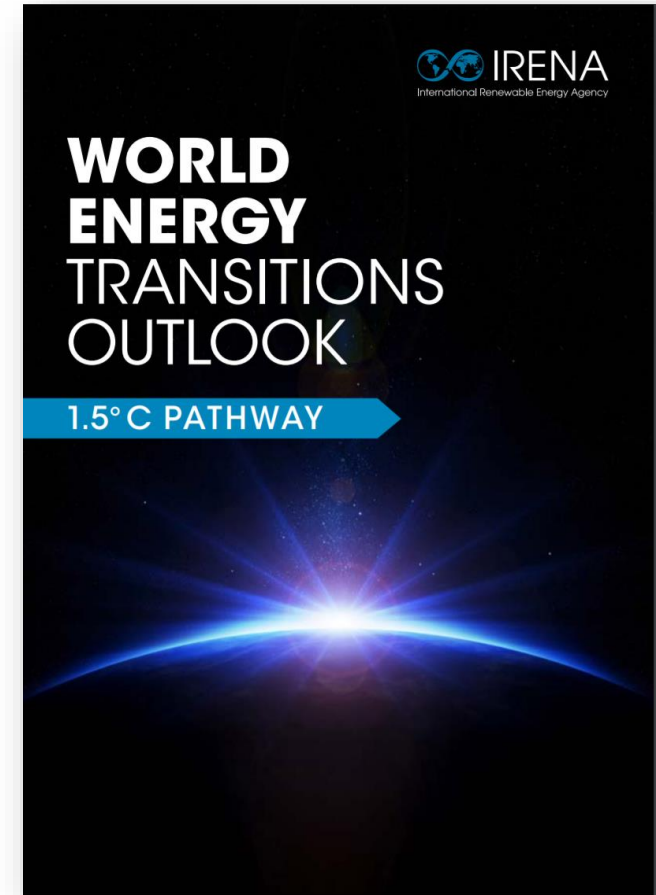
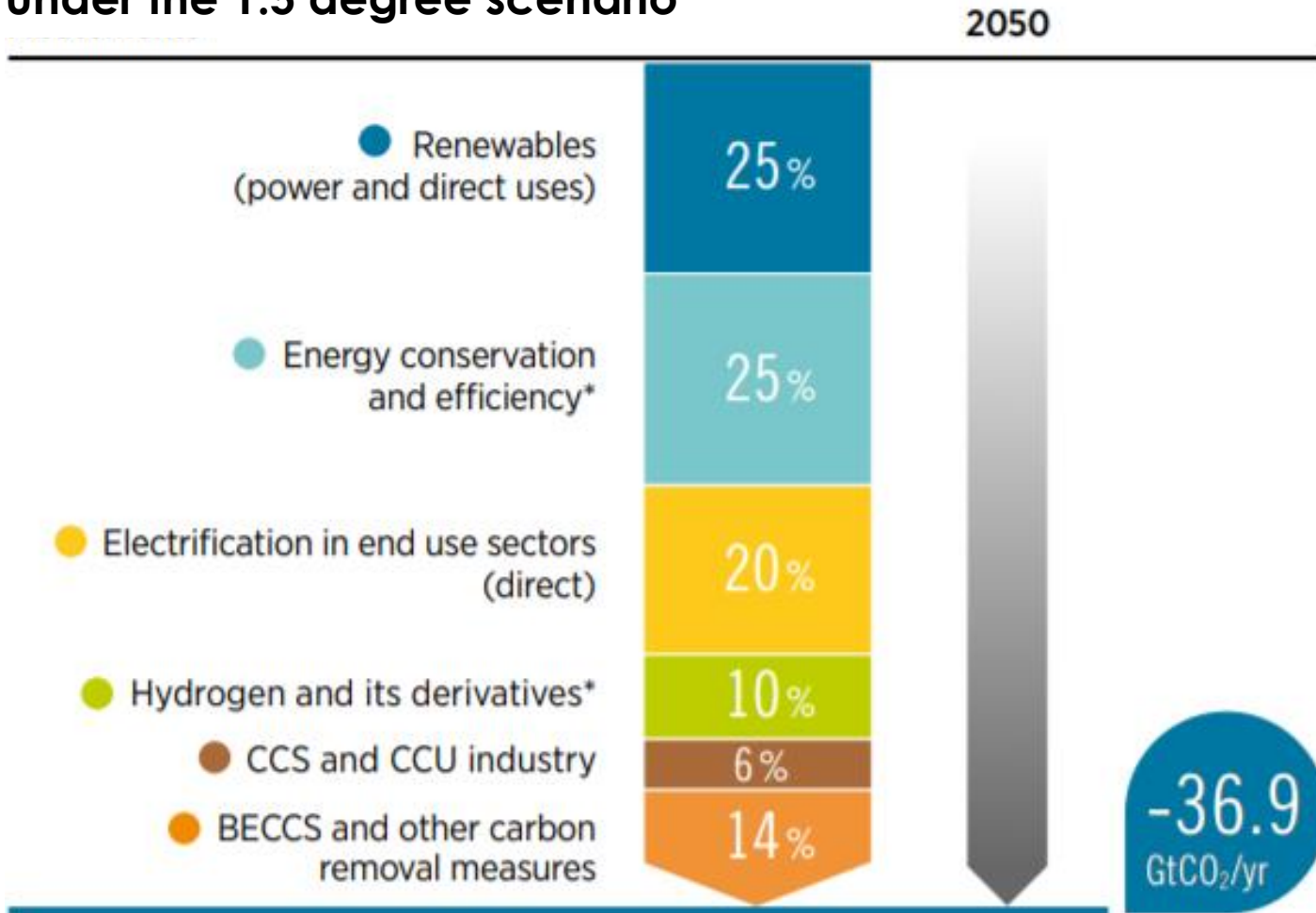


# El camino a seguir



# Seis pilares para la descarbonización

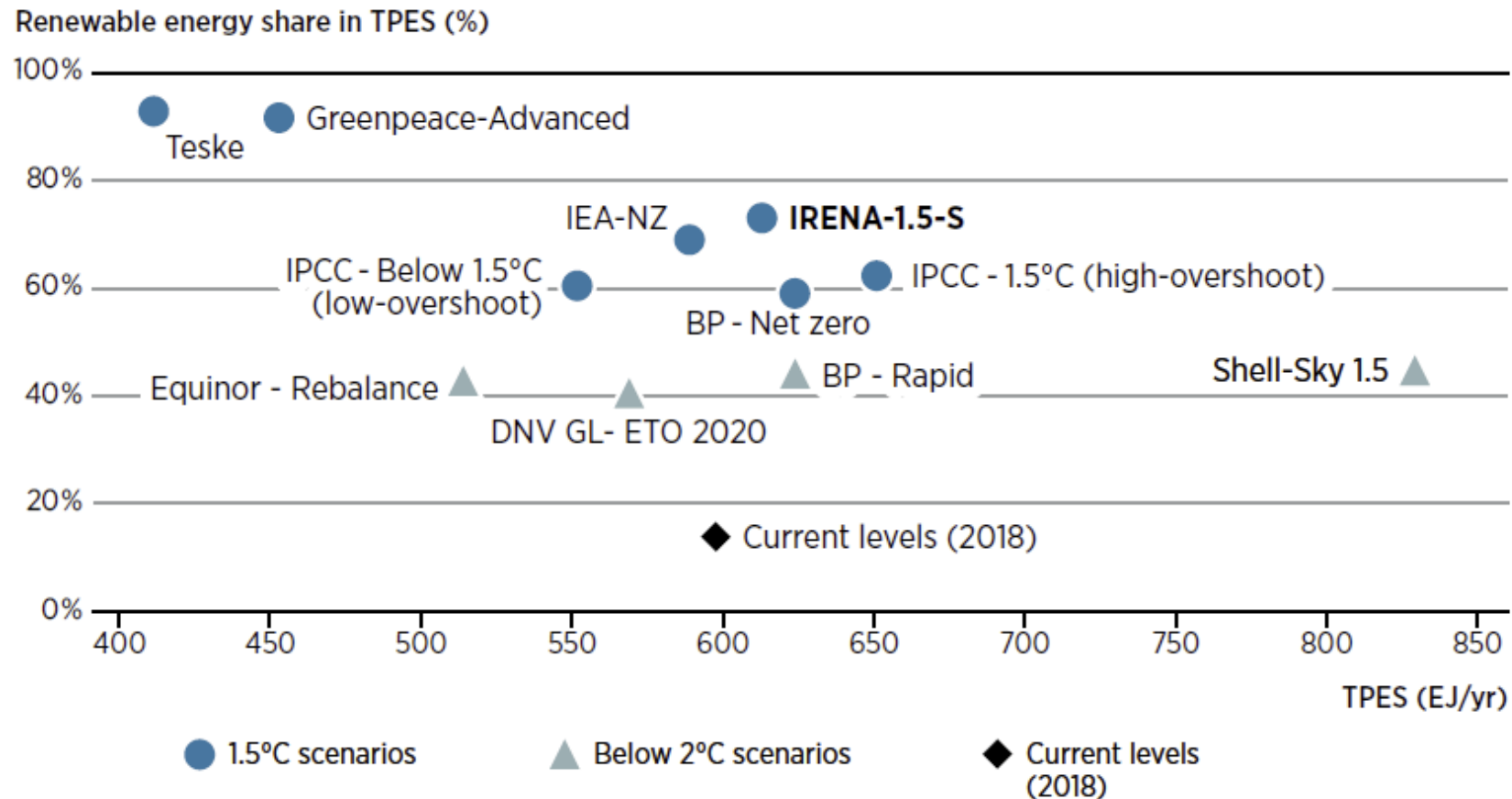
## Carbon emissions abatements under the 1.5 degree scenario



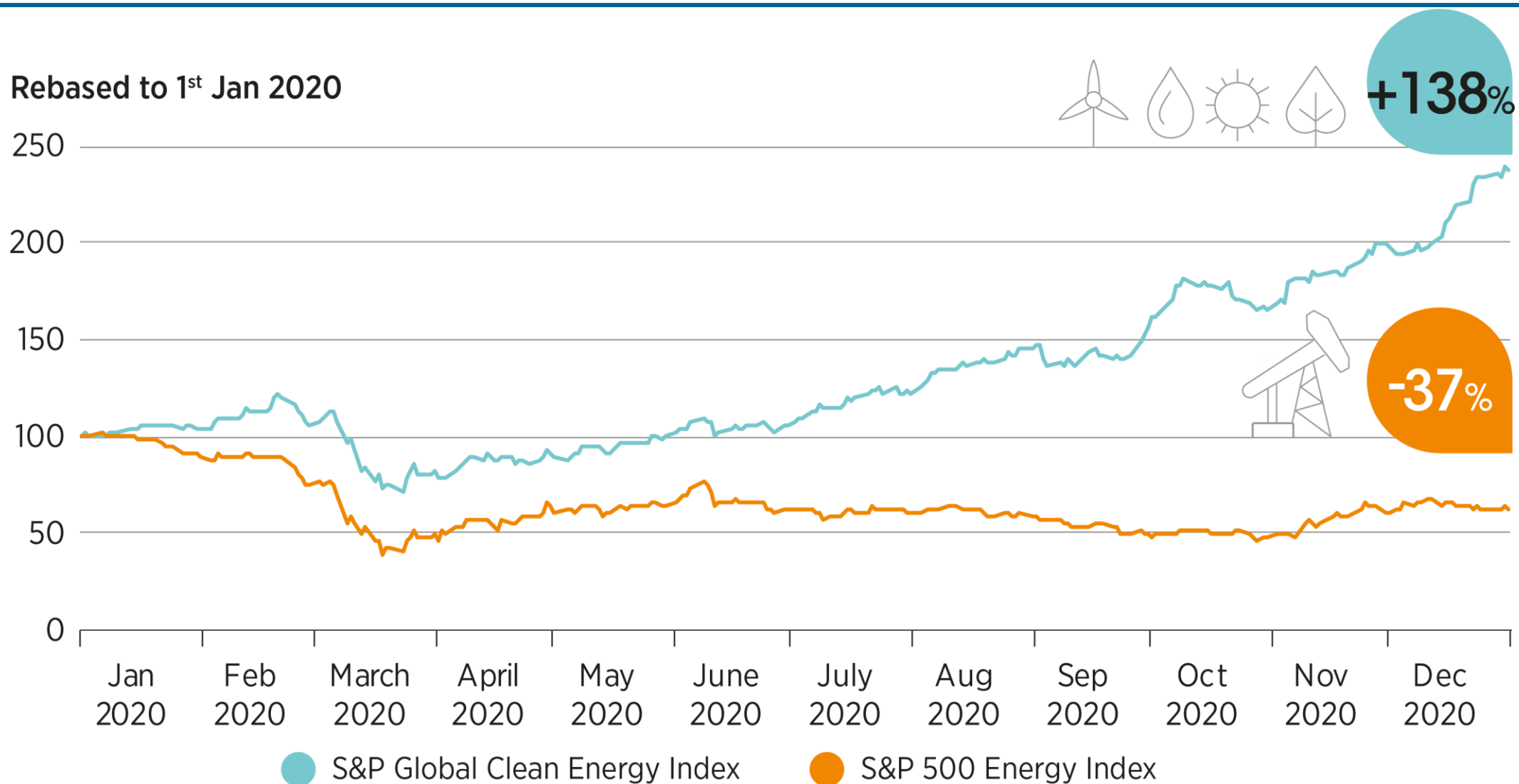
# Diferentes escenarios convergen – renovables en el corazón del sector

## Emerging consensus on the role of renewables

Shares of renewables in total primary energy in 2018 and 2050 in various energy scenarios



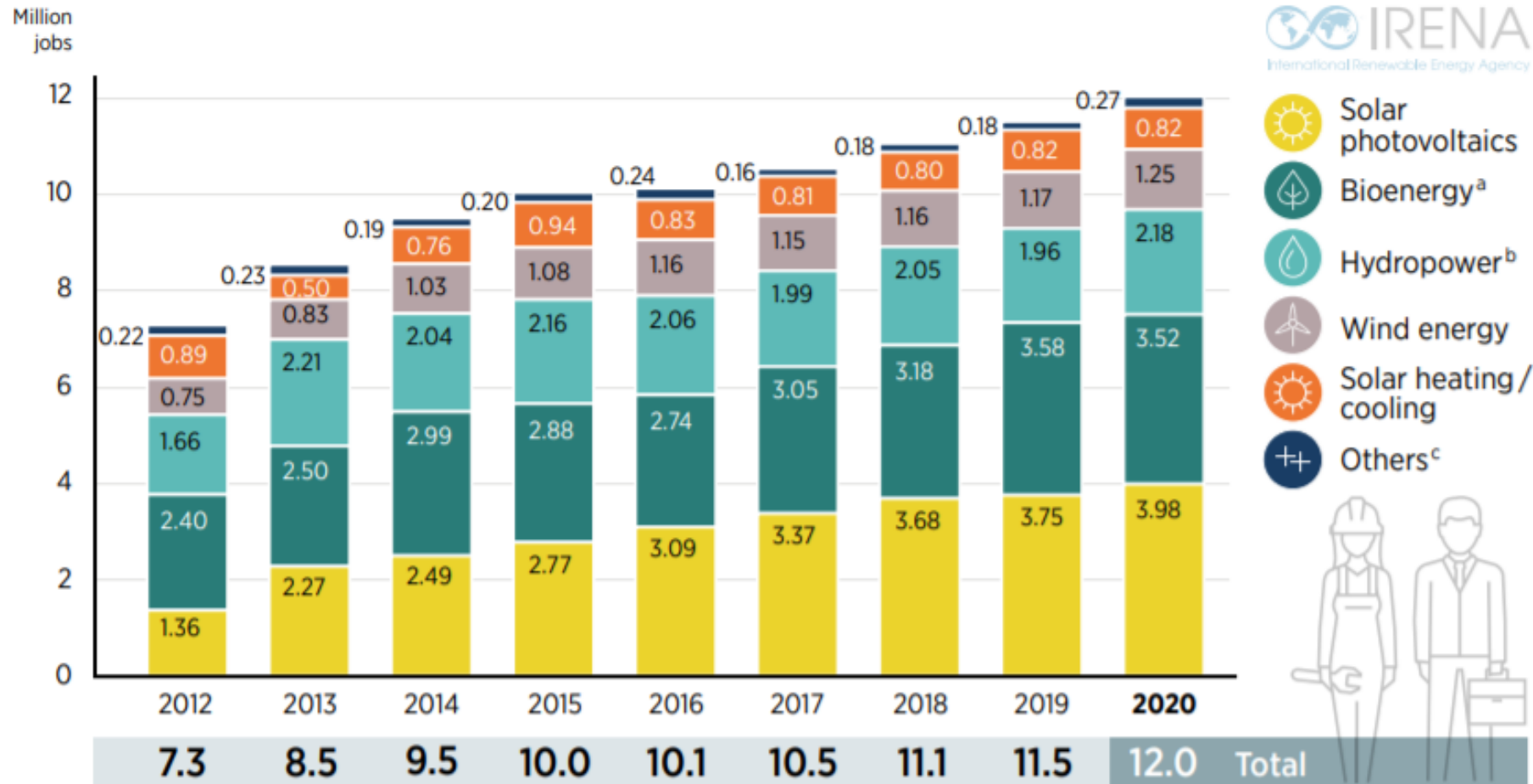
# Tendencia actual en mercados financieros



Inversionistas y mercados financieros están reaccionando a la transición energética

# Crecimiento económico y empleo

**Figure 1.** Global renewable energy employment by technology, 2012-20



<sup>a</sup> Includes liquid biofuels, solid biomass and biogas.

<sup>b</sup> Direct jobs only.

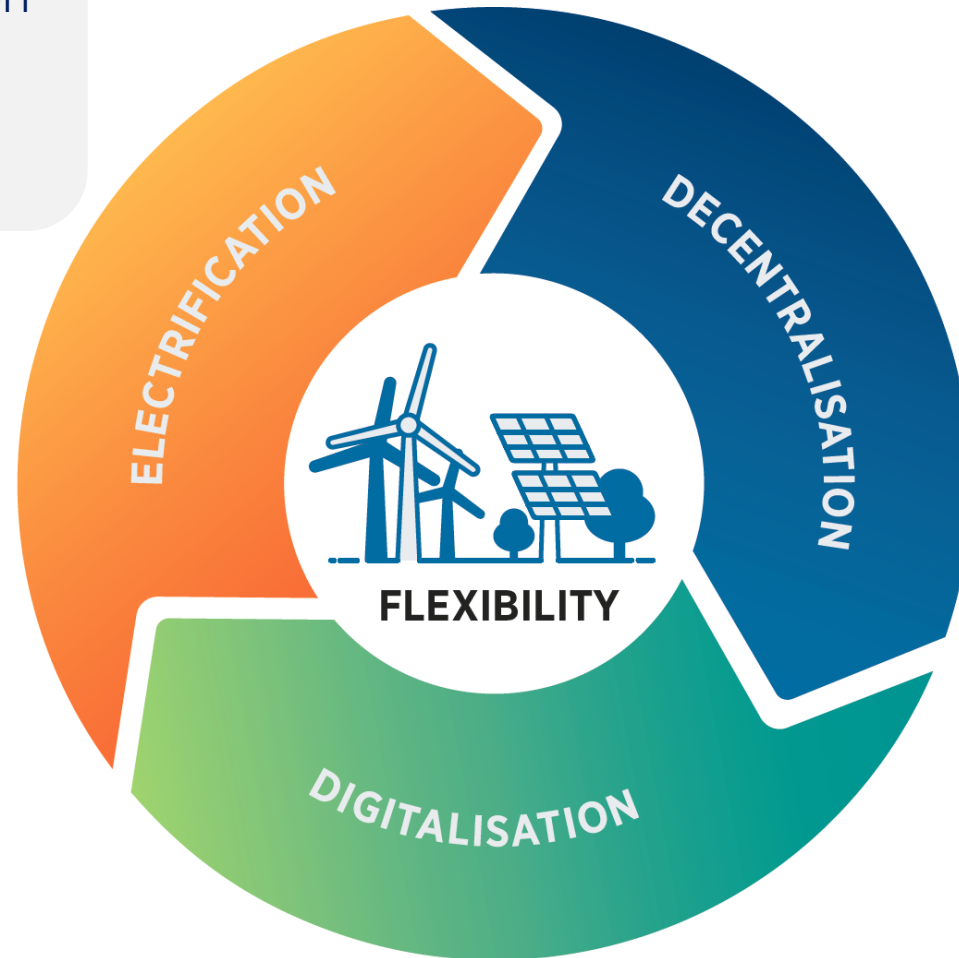
<sup>c</sup> "Others" includes geothermal energy, concentrated solar power, heat pumps (ground based), municipal and industrial waste, and ocean energy.

Source: IRENA jobs database.

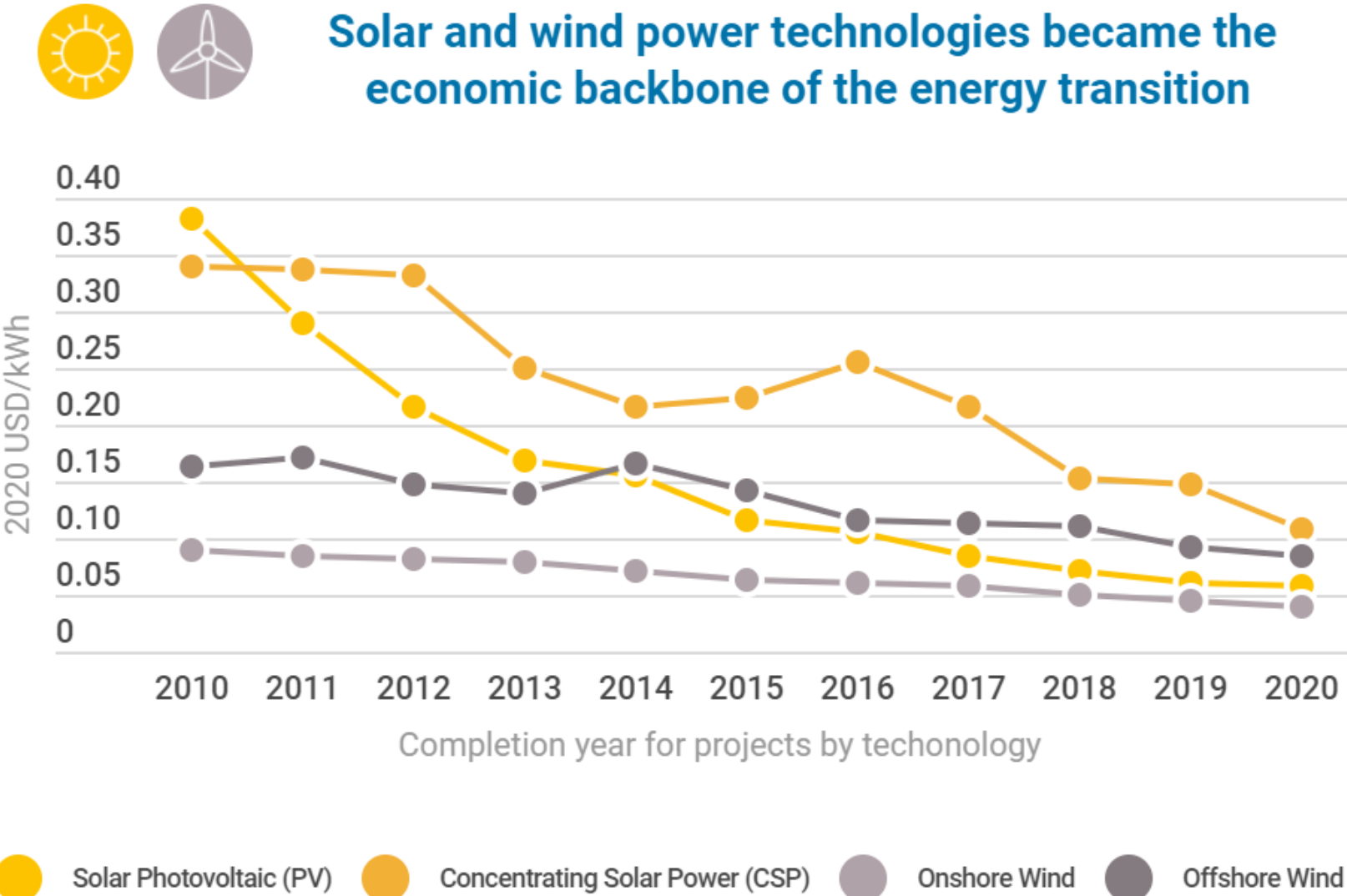


# Tres tendencias innovadoras a nivel global

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



# Competitividad de las energías renovables



Source: IRENA 2021, Renewable Power Generation Costs in 2020

# 2020 – año récord para la electricidad renovable a pesar de la pandemia

2 799 GW

Global renewable generation capacity at the end of 2020

10.3%

Growth in renewable capacity during 2020

261 GW

Net increase in global renewable generation capacity in 2020

64%

Share of new renewable capacity installed in Asia in 2020

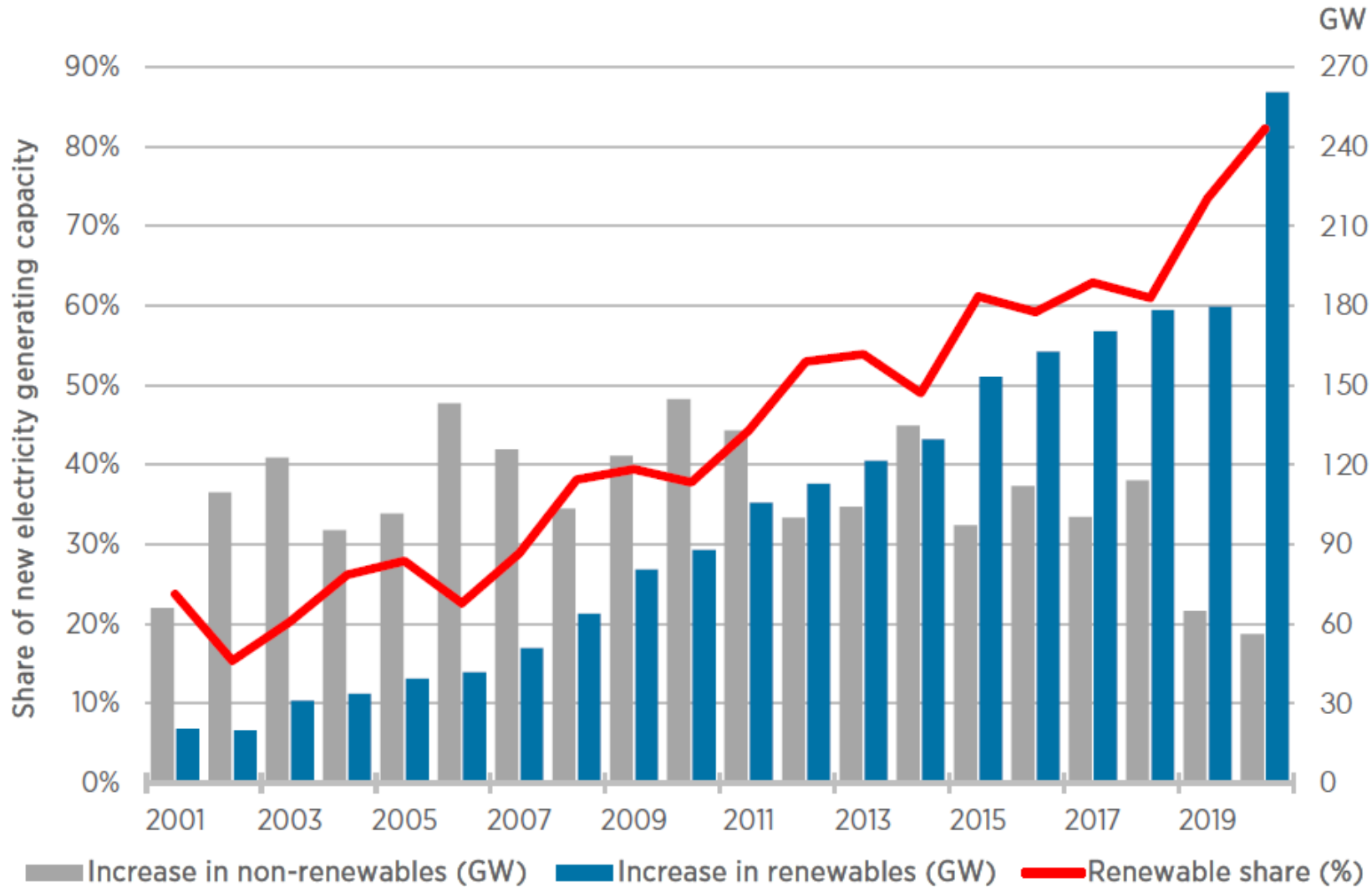
91%

Wind and solar share of new capacity in 2020

82%

Share of renewables in net capacity expansion in 2020

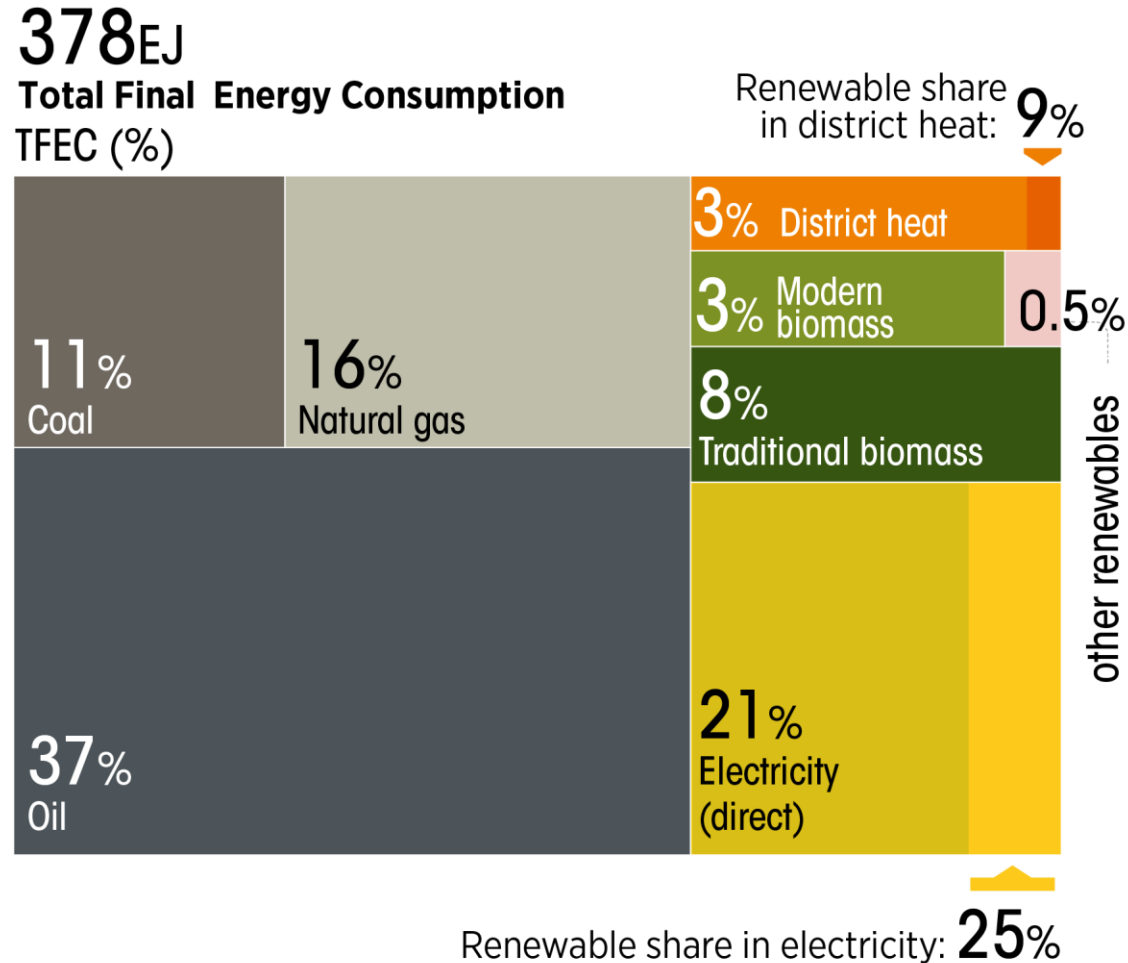
Renewable share of annual power capacity expansion



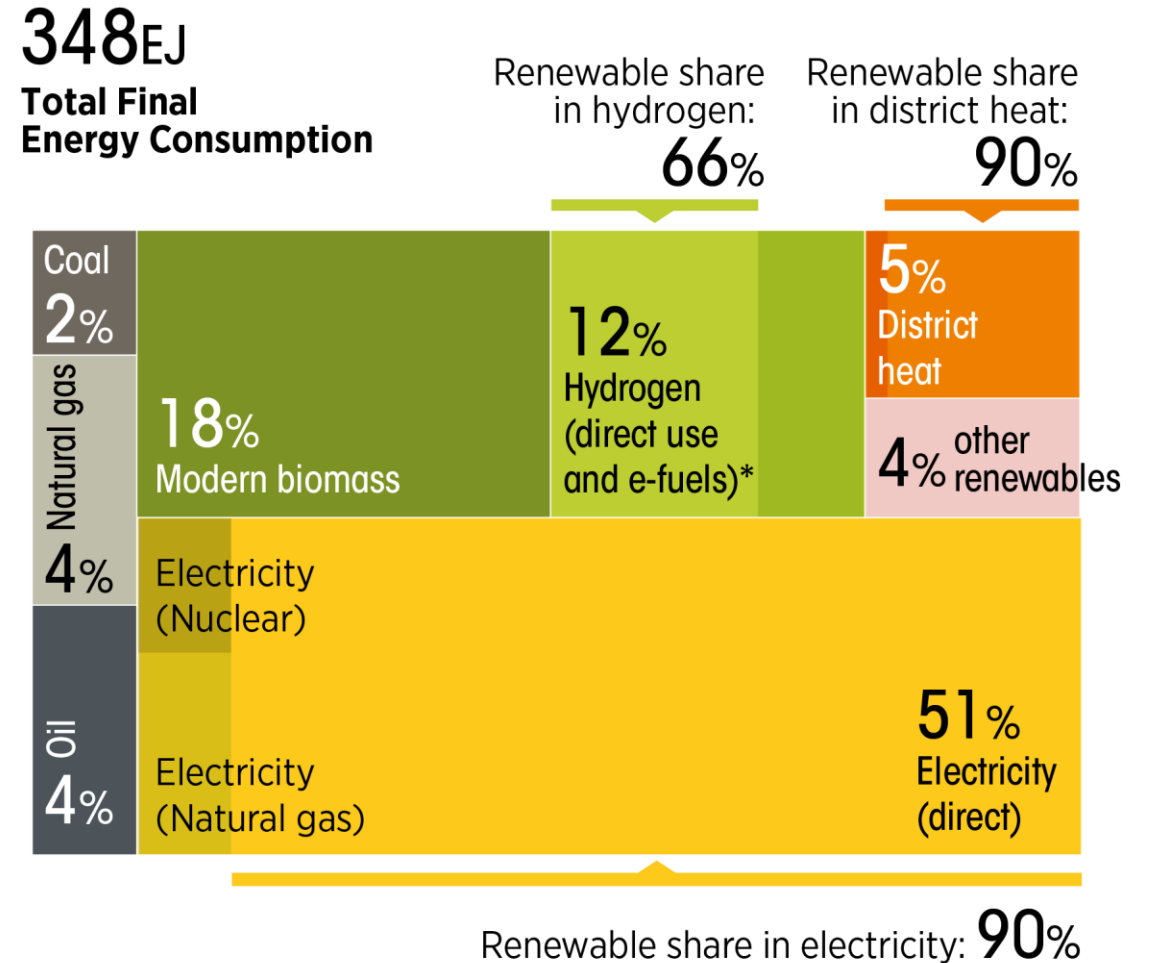
Fuente: IRENA (2020), Renewable capacity

# Electricidad será el Rey de los vectores energéticos

2018



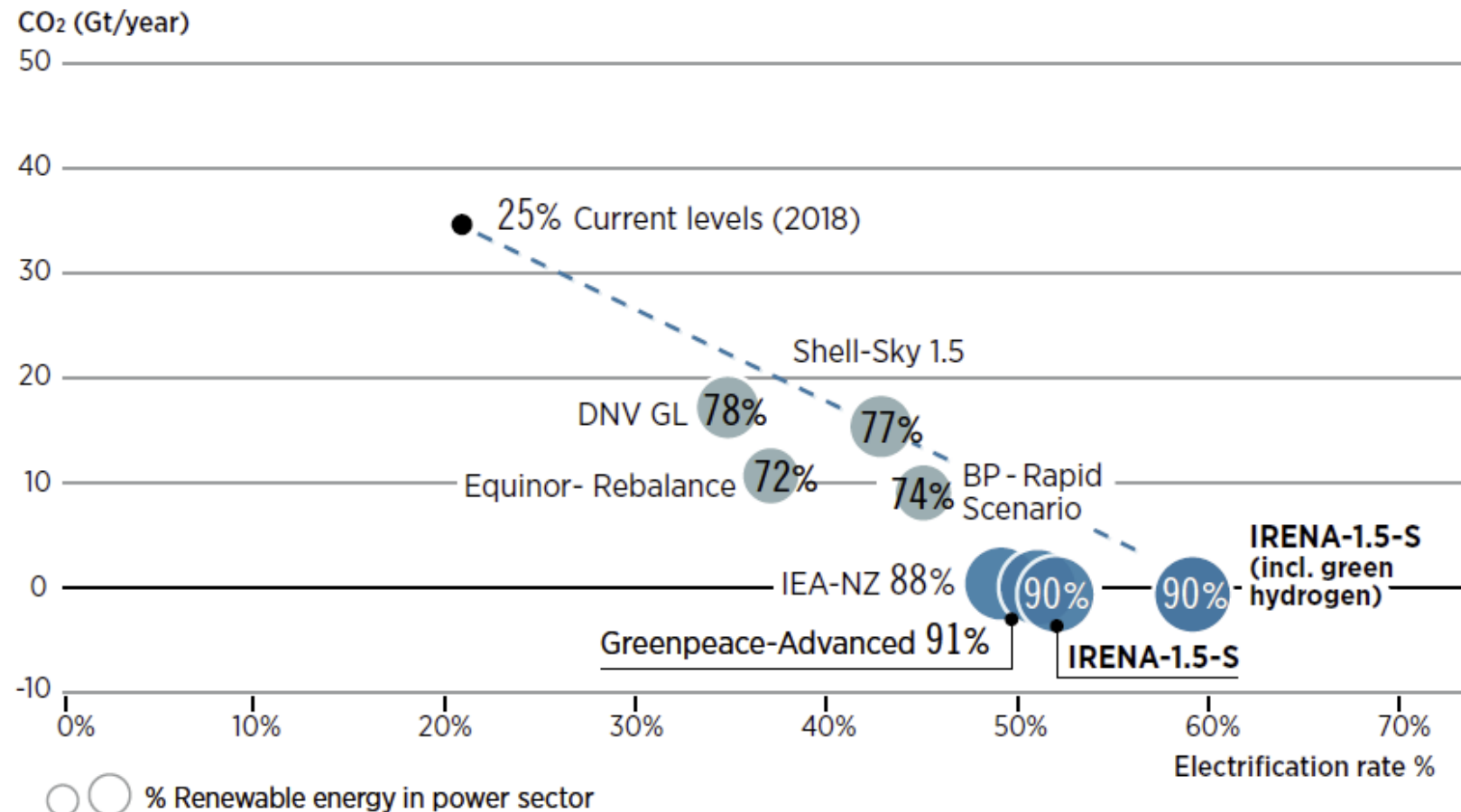
2050 - Where we need to be (1.5-S)



# Diferentes escenarios convergen – electricidad es el vector energético del futuro

## Global energy-related CO<sub>2</sub> emissions in 2050

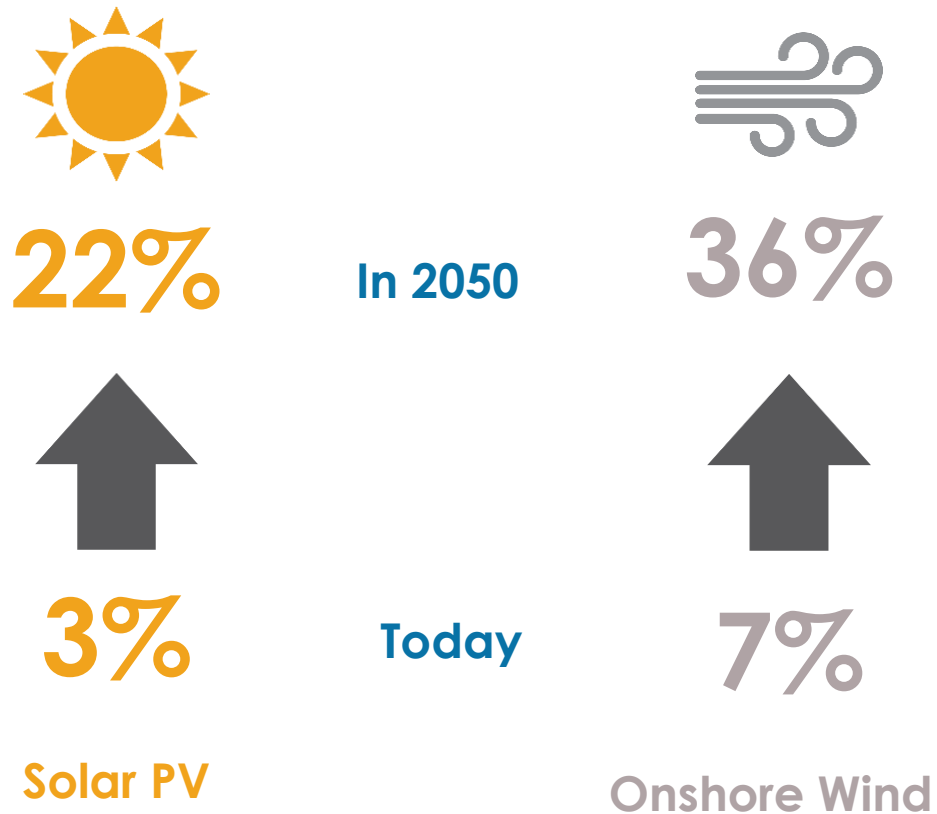
CO<sub>2</sub> emissions versus electrification rates in various energy scenarios





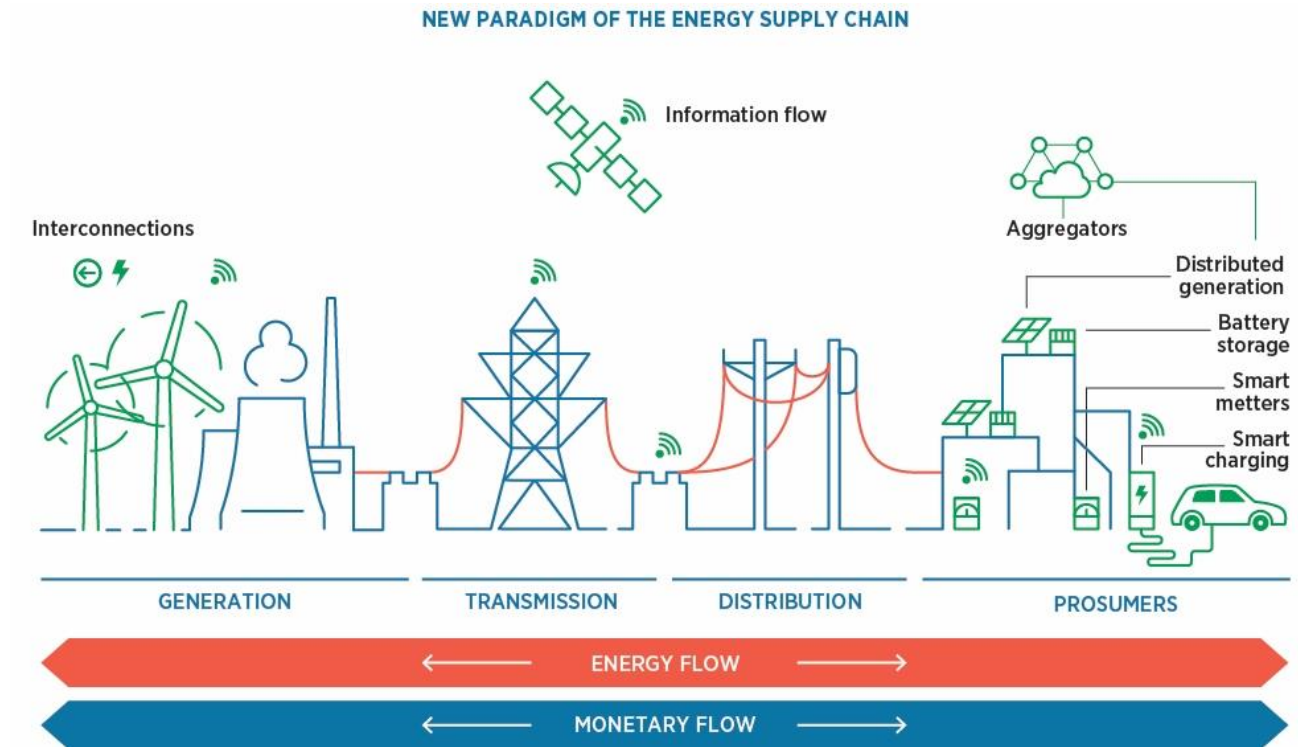
# Energías renovables variables (solar FV y eólica) en el corazón de la transición

## Shares in the generation mix



Wind and Solar penetration	
Denmark	65%
Kenya	48%
Nicaragua	44%

# Necesitamos sistemas eléctricos mas flexibles

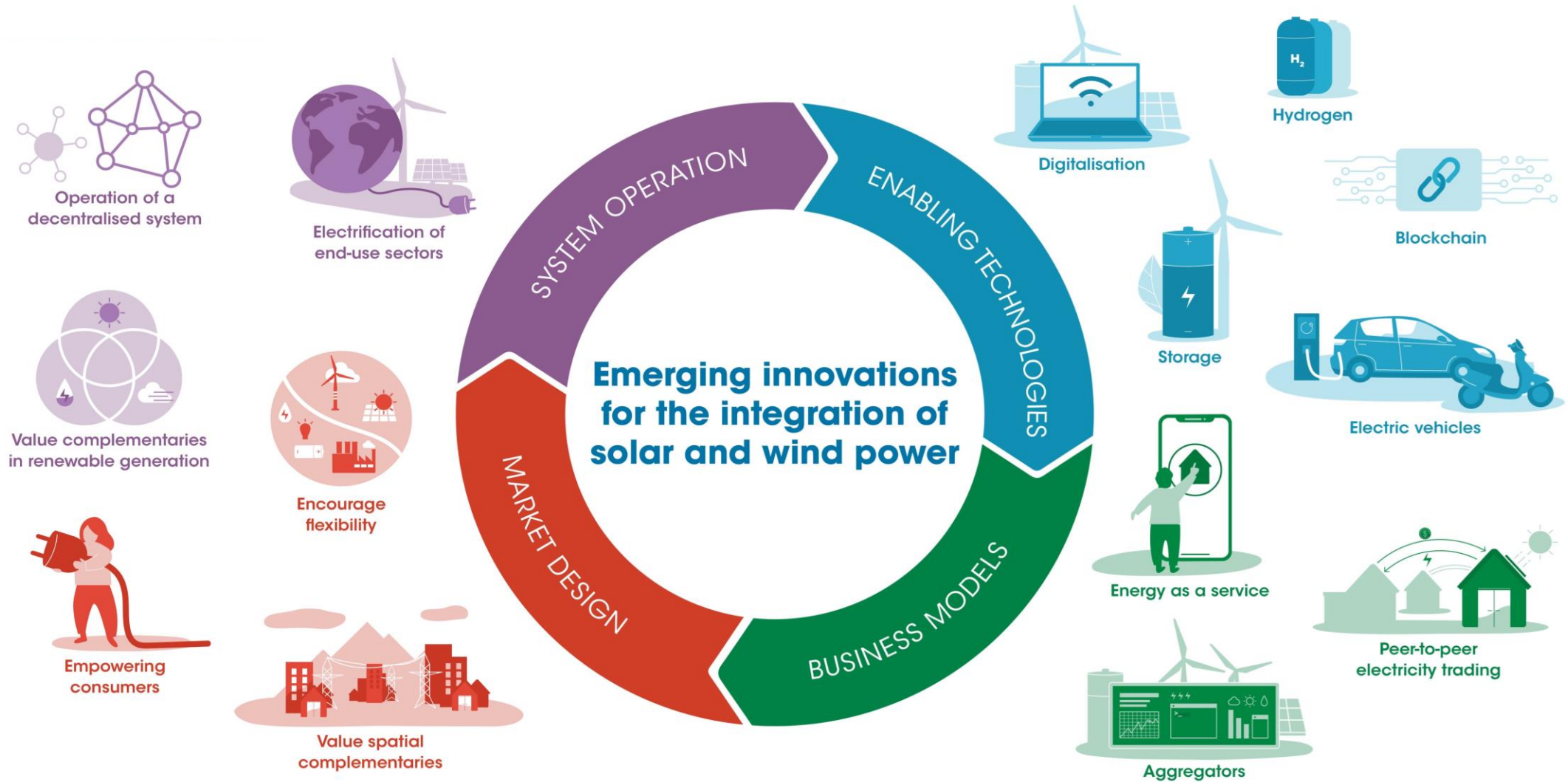


## Flexibility providers in tomorrow's system:

Flexible generation,  
Regional markets,  
Demand response,  
Storage, Power-to-X.

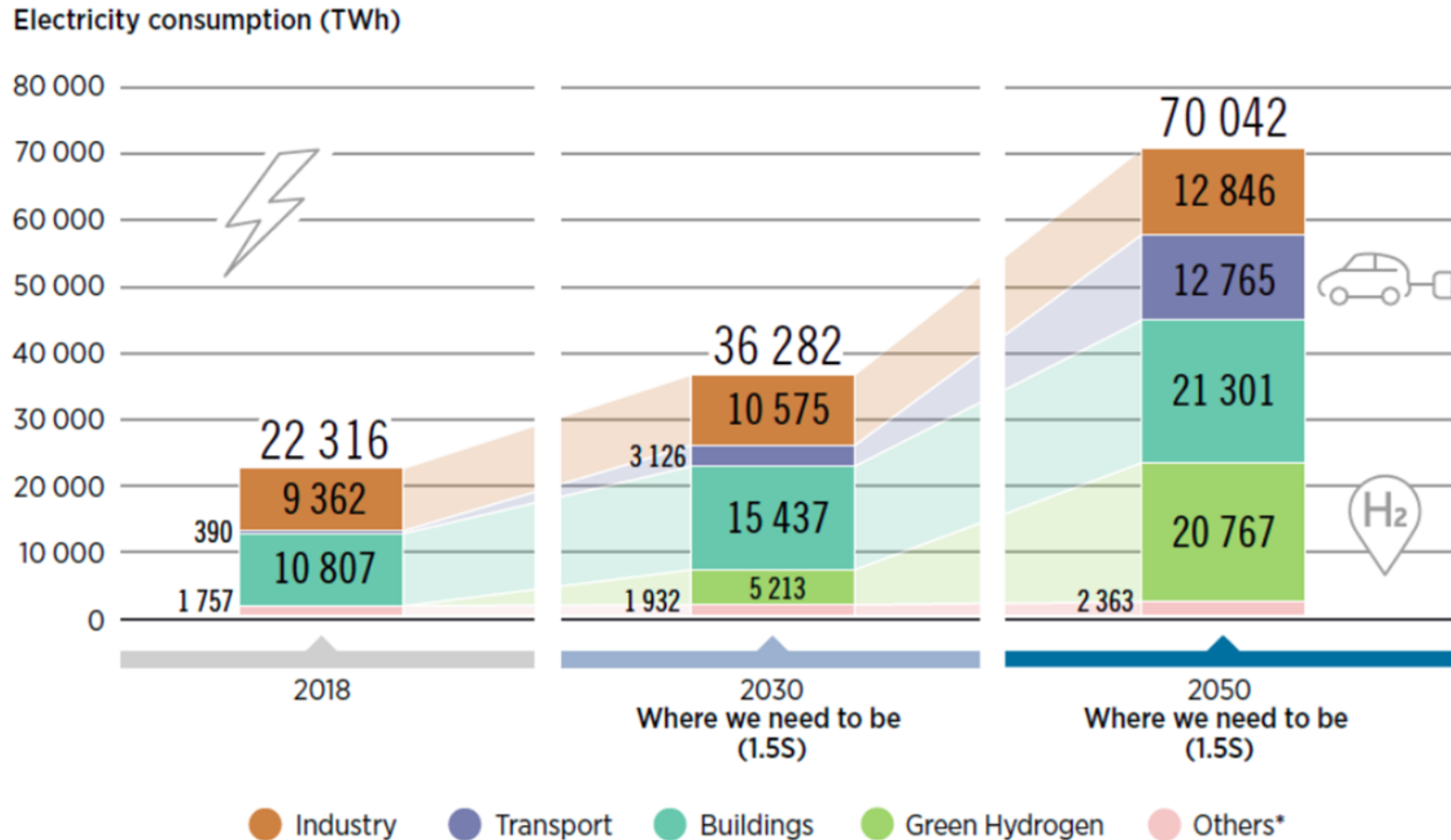


# Innovación tiene la llave a una electrificación inteligente



# El reto de la electrificación de los sectores de la demanda

Electricity consumption by sector, 2018, 2030 and 2050 (TWh/yr) in the 1.5°C Scenario



## Key considerations

- 1- Annual **Energy demand**: must come from renewables  
– *power system flexibility*
- 2- **Load profile**: peak demand  
– *infrastructure*
- 3- **Investments** in infrastructure for electrification in the same order of magnitude as RE capacity: ~ 900 billion USD/year -

*Smart electrification is the only option*

# Innovación para electrificación inteligente – el caso de California

## Technology & infrastructure



### EVs

- 420.000 full EVs on road

### Diversity and ubiquity of charging infrastructure

- 57,000 Level 2 + 4,900 DC fast (public chargers)
- 240,000 Level 2 + 10,000 DC fast (2025)



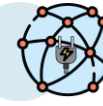
### Batteries and battery recycle

- lithium-ion batteries
- ReCell Center: first advanced battery recycling R&D center



### Digitalization

- Interoperability and connectivity : BMW piloting the Chargeforward System Architecture



California

## Market design & regulations

### V2G regulatory framework

- Grid codes enables V2G charging: The new Rule 21 revisions clarify that V2G-DC or V2G-AC systems can be interconnected
- Recommendation to Allow V1G and V2G to qualify for SGIP, but V1G would get less incentive compared to V2G based on permanent load shift logic



### Smart charging enablement by wholesale market constructs

- V2G company Nuvve participating in California's wholesale energy markets to help balance the grid



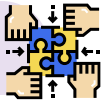
### Time of Use Tariffs for EVs (US\$/kWh)

- Daily Peak at 0.5 (4 - 9 p.m.), Partial Peak at 0.3 (3 - 4 p.m. and 9 p.m. - 12 a.m.) and Off-Peak at 0.15 (all other hours)



### Cooperation of regulatory agencies for VGI

- The Vehicle Grid Integration Working Group that brings together CARB, CAISO, CEC and CPUC



### Management of EV load to integrate renewables

- BMW Chargeforward takes into account renewables: shifting charging during the late morning hours can help with oversupply of solar generation.



### Management of EV load to defer grid updates

- PG&E is purchasing distribution capacity for either generation or load (Evs can participate)



### EV as a resiliency solution

- EV battery and solar as backup systems for wildfires and blackouts



## System operation & planning

### EV load peak shaving

- ChargeForward vehicles can create an average of \$325 in estimated grid savings annually per vehicle in California



### Battery second life

- California Awards \$10.8M to Reuse EV Batteries in Solar & Microgrid Projects (4 projects)



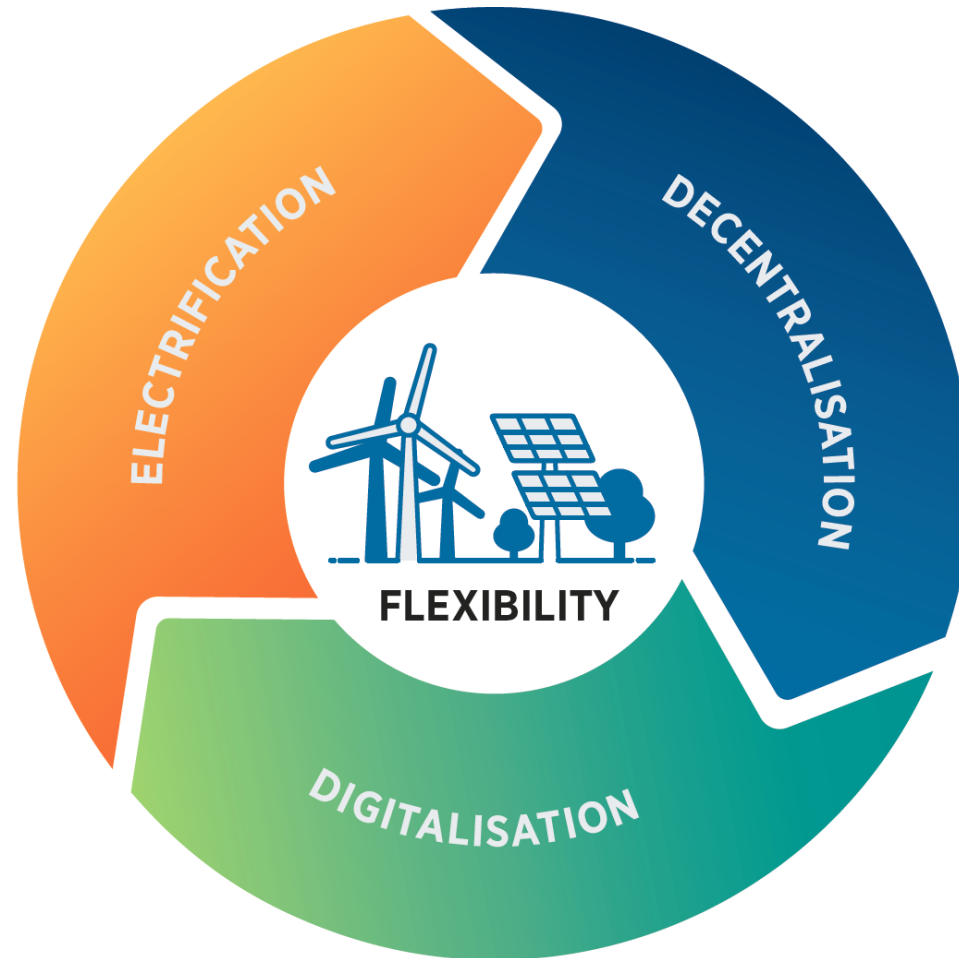
### Charging stations ownership and operations

- Four community choice aggregators (CCAs) are funding \$65 million in infrastructure to support the rising number of electric vehicles (EVs) in the state.





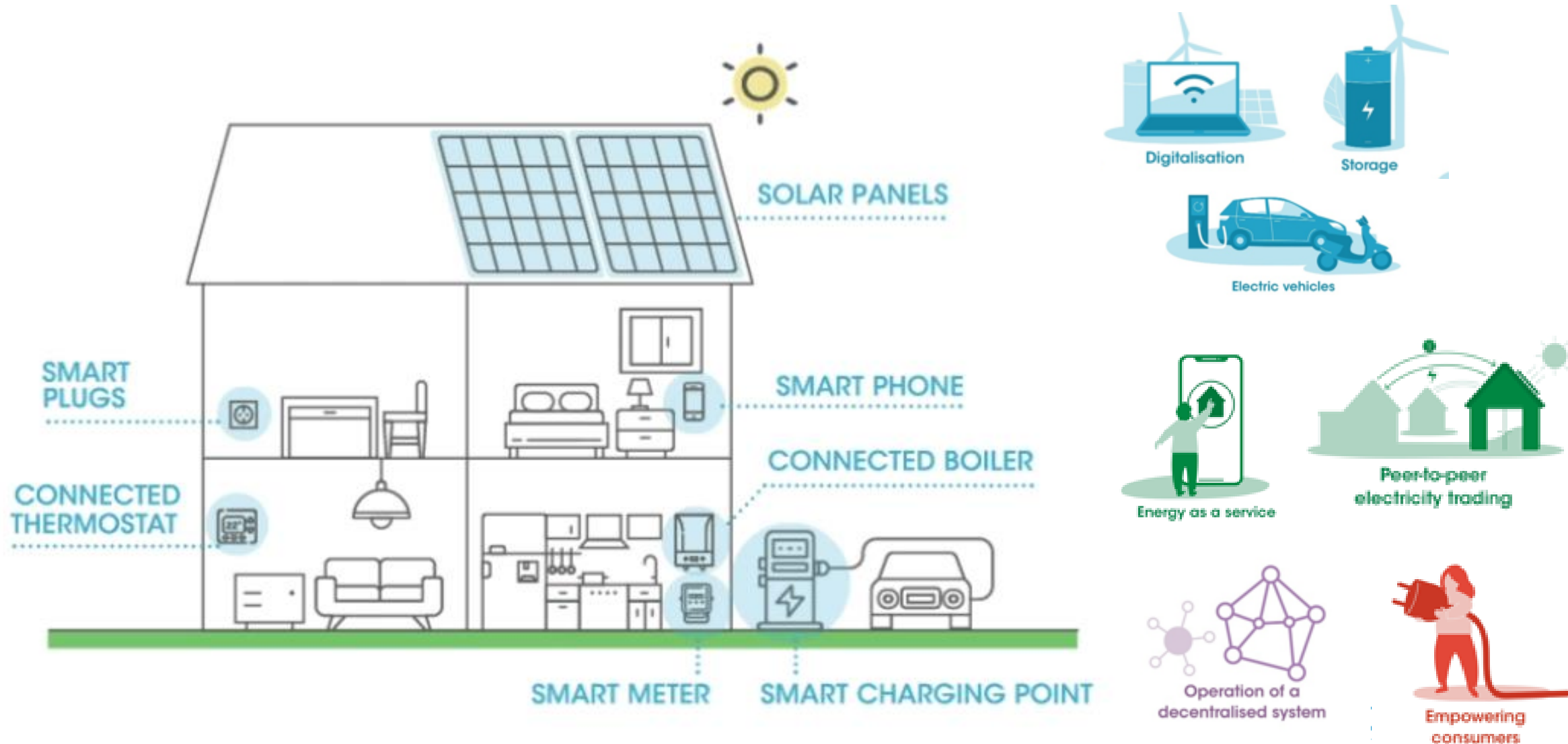
# Tres tendencias innovadoras a nivel global



- The increasing deployment of **Distributed Energy Resources (DERs)** turns the consumer into an active participant, **fostering demand-side management**.

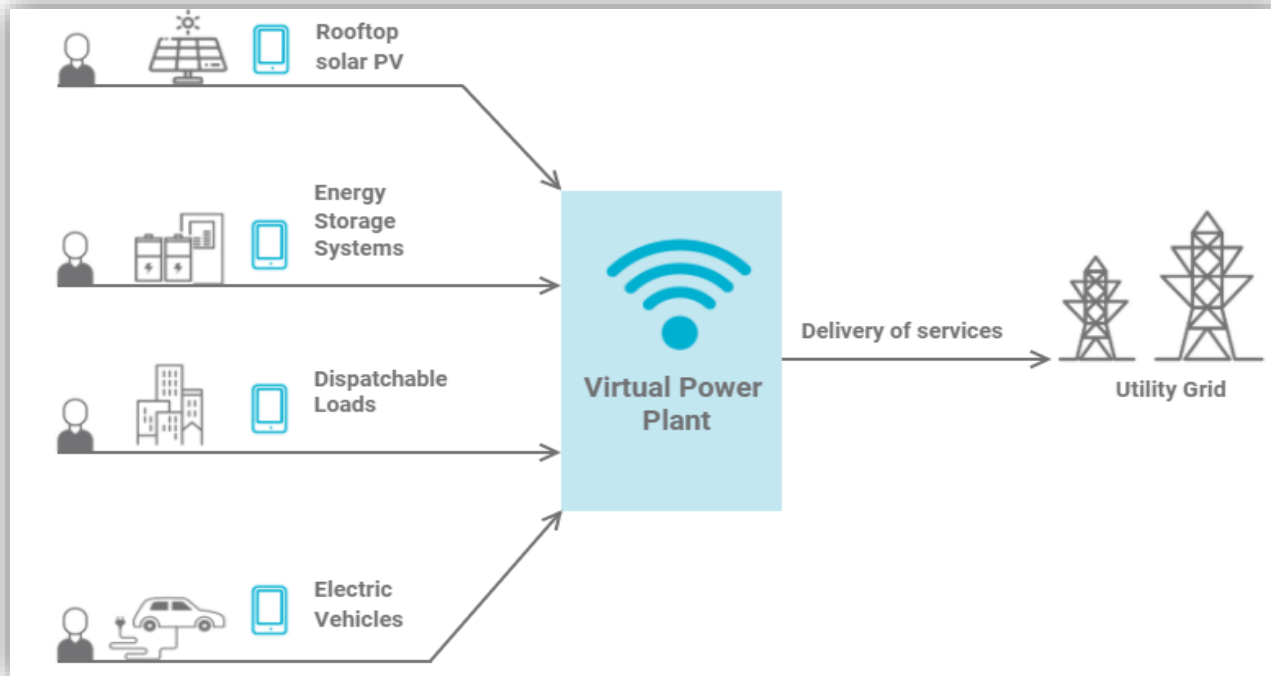
# Descentralización - prosumidores

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



# Modelos de negocio innovadores: Agregadores

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"> <li>• Forecasting and trading of distributed energy resources</li> <li>• Optimised dispatching of distributed energy resources according to intraday pricing on spot markets</li> <li>• Delivery of ancillary services to transmission (and potentially distribution) system operators</li> </ul>

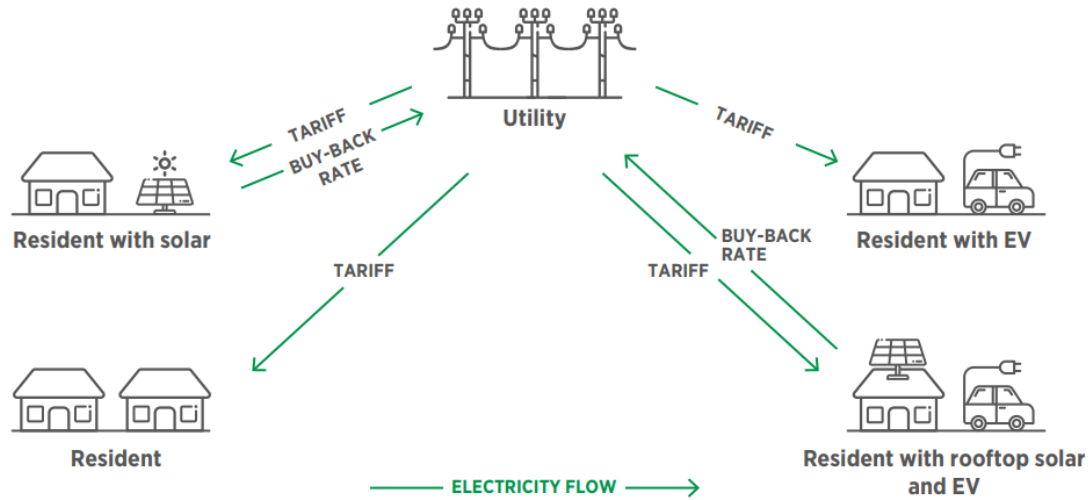


**In South Australia, aggregators can meet 20% of daily power demand and provide 30% savings on energy bills.**

Source: IRENA (2019) Innovation landscape brief: Aggregators

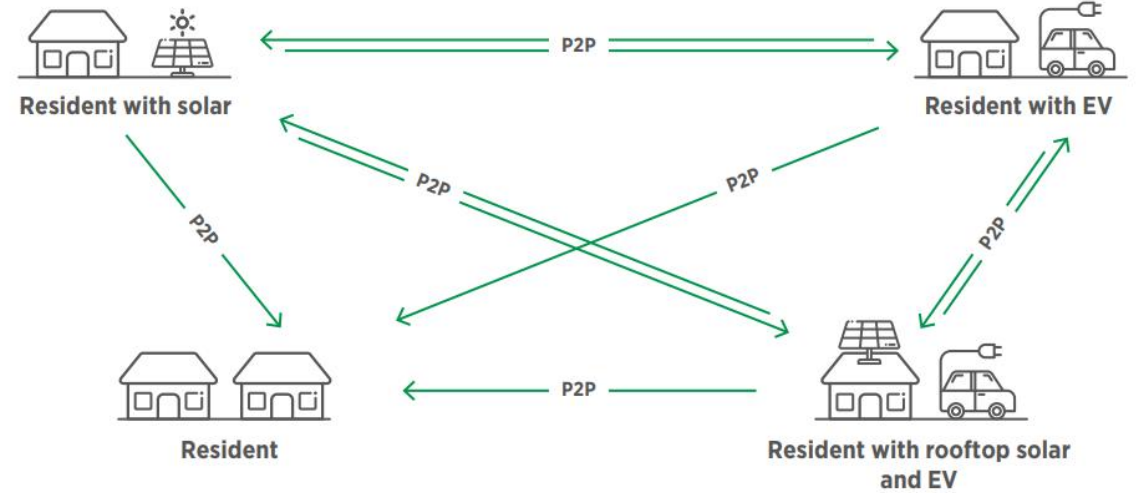
# Modelos de negocio: comercialización de electricidad entre pares

## Traditional trading model






Source: Adapted from Liu et al., 2019

## Peer to peer electricity trading model



Global electricity generated by distributed PV in 2019 ~ 350 TWh

## 2 KEY ENABLING FACTORS

-  Distributed renewable energy resources
-  Digitalisation
-  Conducive regulatory framework

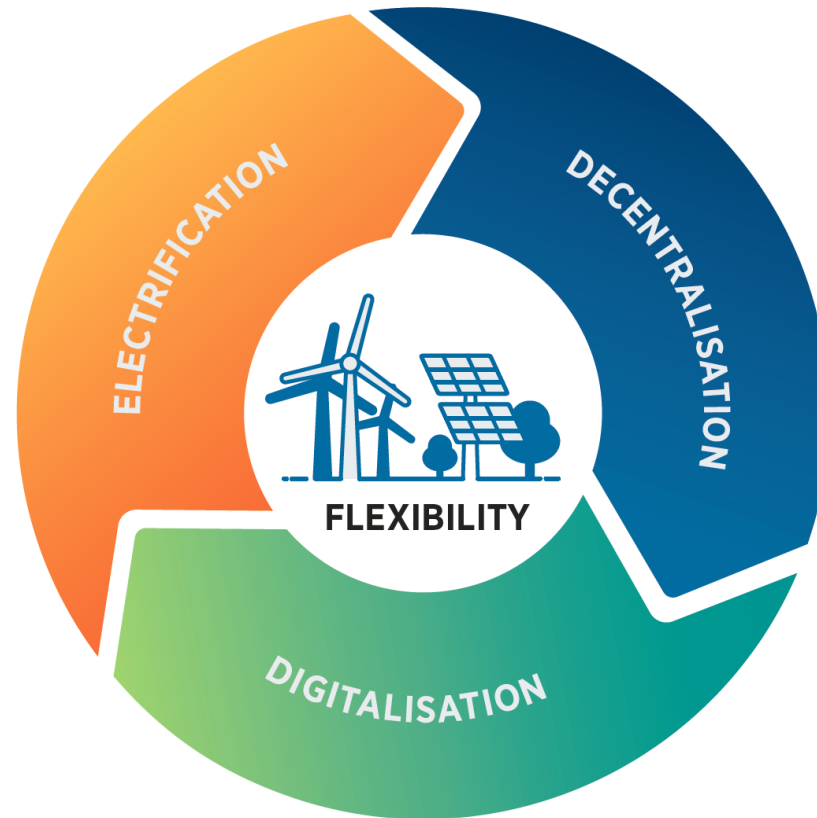
## 3 SNAPSHOT

- 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.



# Tres tendencias innovadoras a nivel global

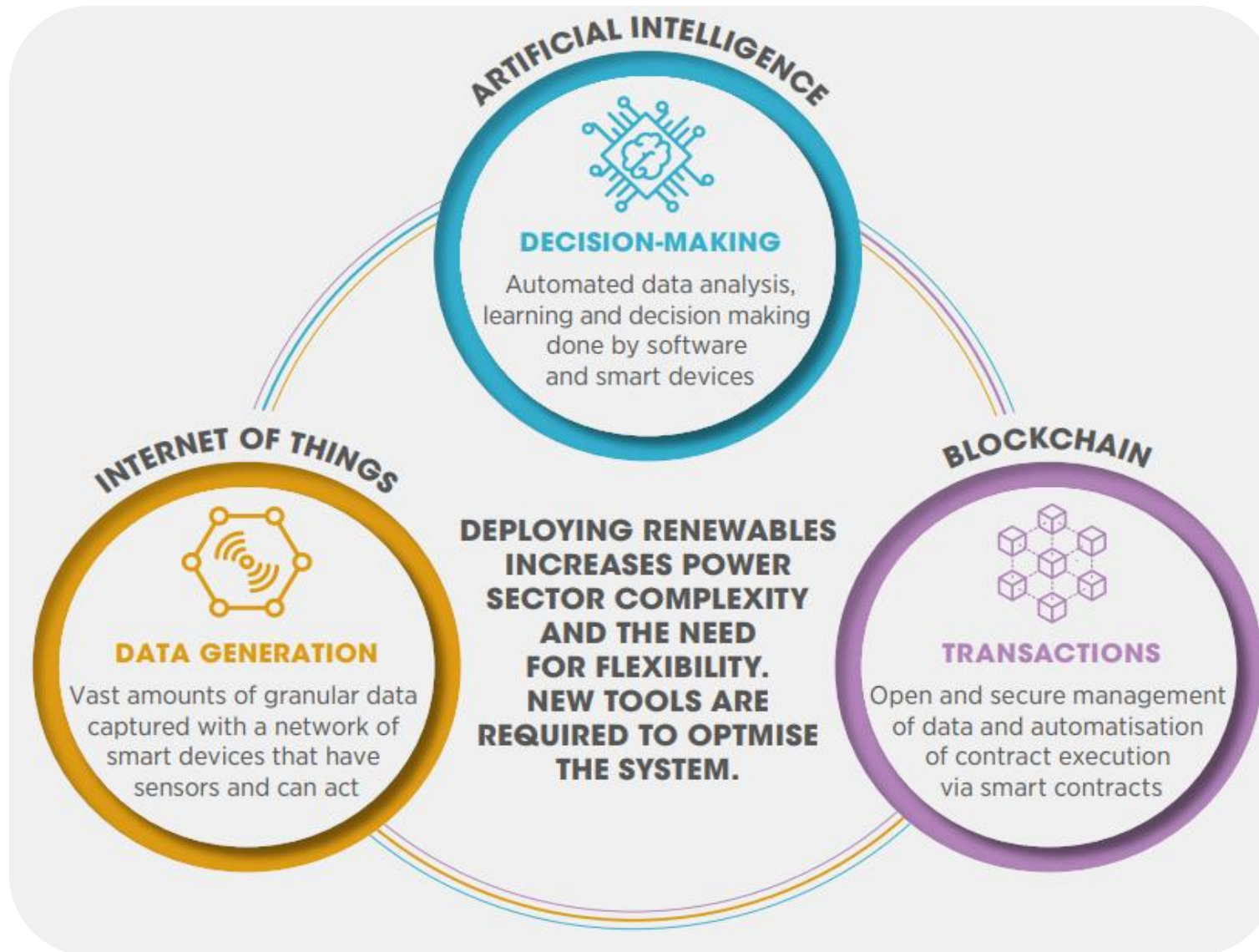
---



- Digital technologies enable **faster response, better management of assets, connecting devices, collecting data, monitor and control**

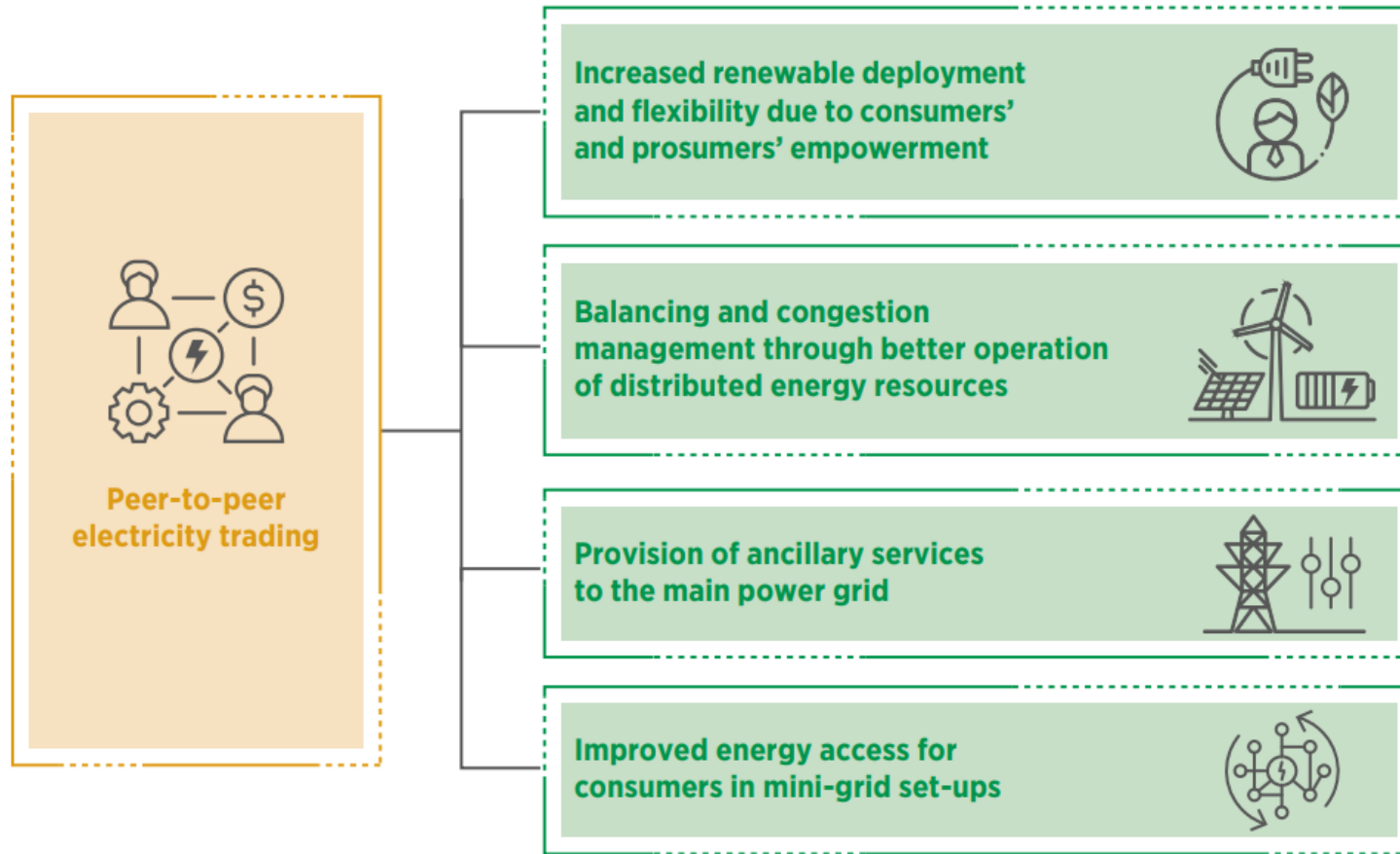


# Descentralización requiere digitalización



# Tecnología inteligente debe resultar en soluciones inteligentes para el sector eléctrico

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



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

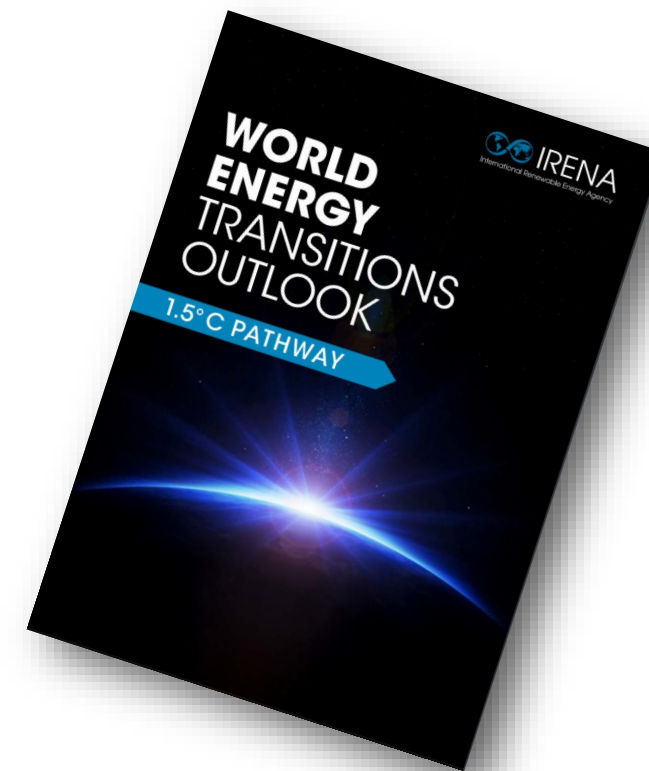
**Consider both - user and system needs:**

- 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 in demonstration projects and regulatory sandboxes



# Gracias



[www.irena.org](http://www.irena.org)



[www.twitter.com/irena](https://www.twitter.com/irena)



[www.facebook.com/irena.org](https://www.facebook.com/irena.org)



[www.instagram.com/irenaimages](https://www.instagram.com/irenaimages)



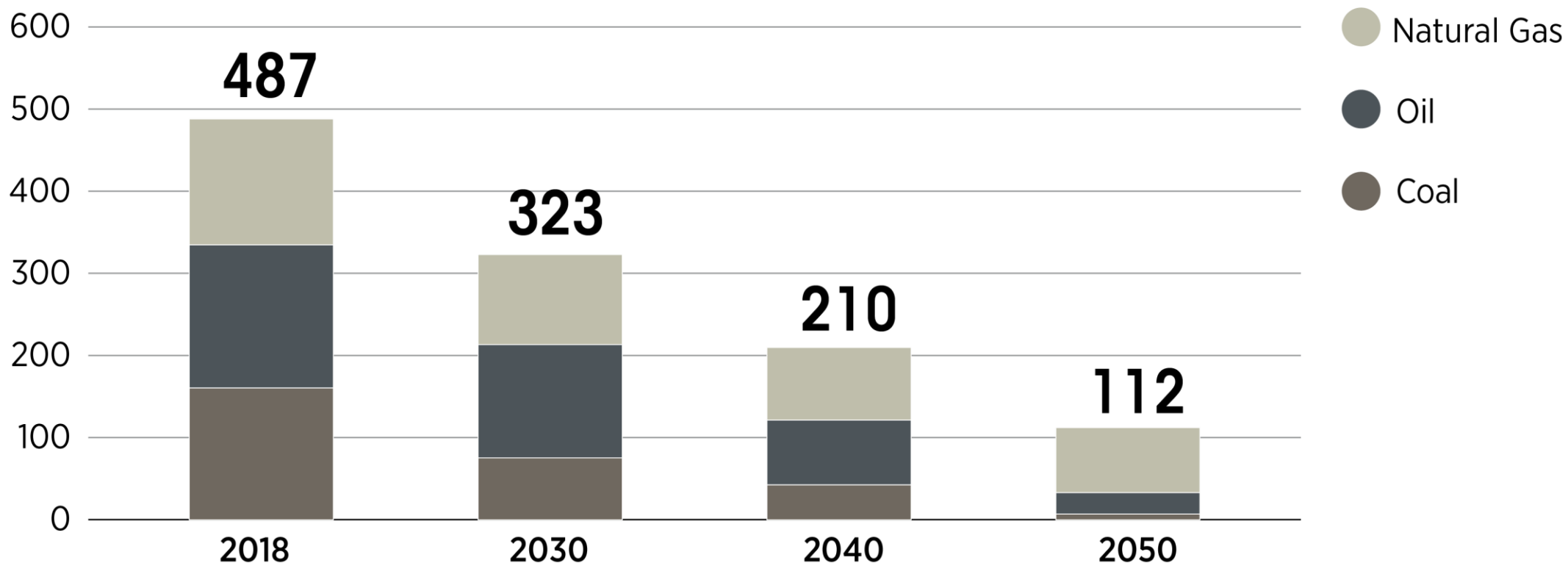
[www.flickr.com/photos/irenaimages](https://www.flickr.com/photos/irenaimages)



[www.youtube.com/user/irenaorg](https://www.youtube.com/user/irenaorg)

# Escenario 1.5oC – el papel de los combustibles fósiles declina

Fossil fuels primary supply (EJ)



- Fossil fuel use could decline by more than 75% by 2050, based on the rapid transition measures starting now.

# Consumidores en el corazón de la transición energética

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.

## 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.

## DISTRIBUTED ENERGY RESOURCES

