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Our presenters



Matt Brown

MATT BROWN

Vice President

matt.brown@afry.com

+44 7973 199 112



Stephen Woodhouse

STEPHEN WOODHOUSE

Director

AFRY Management Consulting, Oxford, UK

stephen.woodhouse@afry.com



Shweta Jadhav

SHWETA JADHAV

Consultant

AFRY Management Consulting, Oslo, Norway

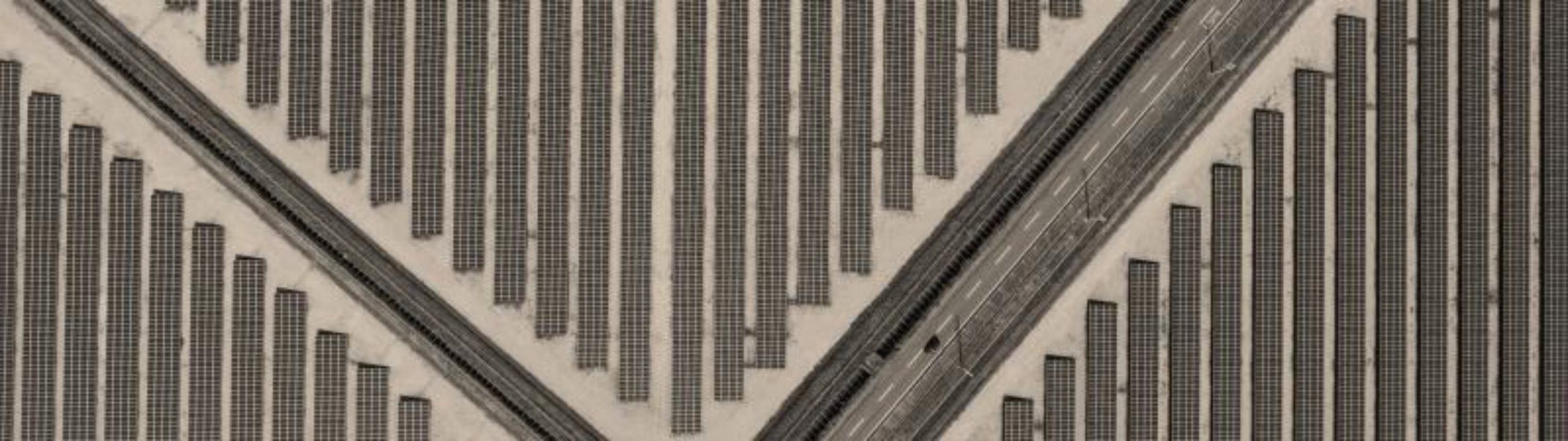
shweta.jadhav@afry.com



INDIA POWER MARKET- VISION FOR 2030

Webinar

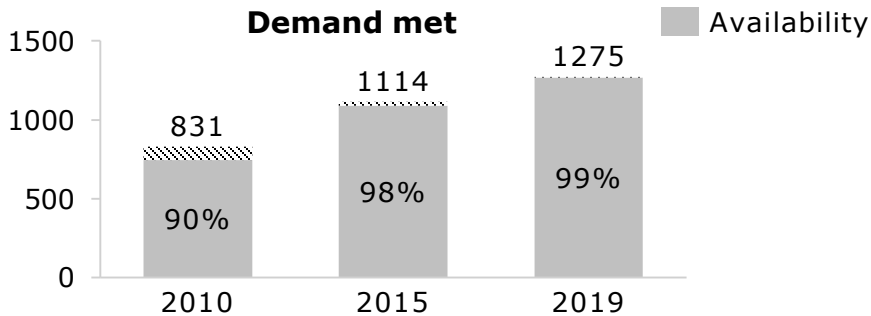
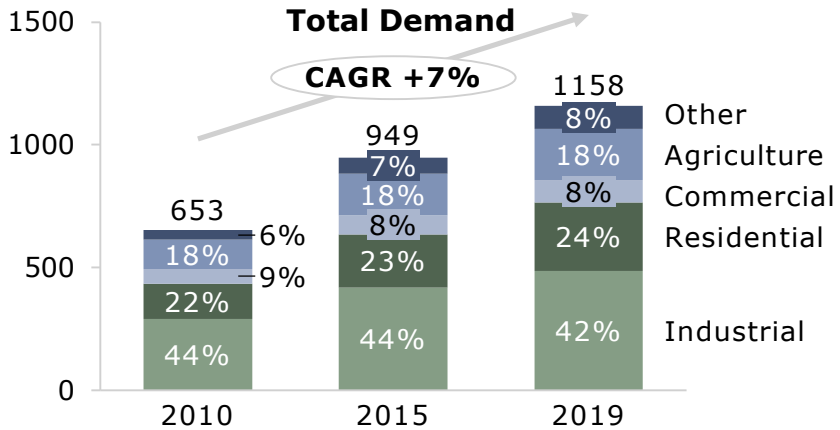
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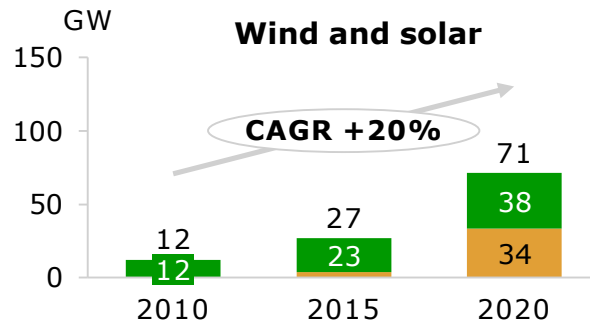
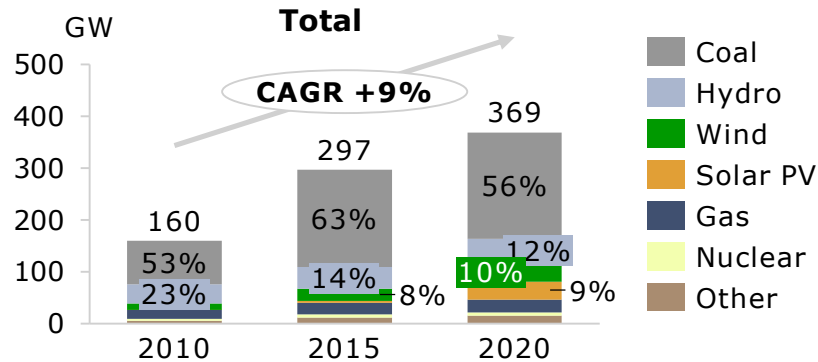
Power market evolution 2010 - 2030

India's power sector has transformed in the last decade, improving reliability in the face of fast-growing demand under the regime of a National Plan

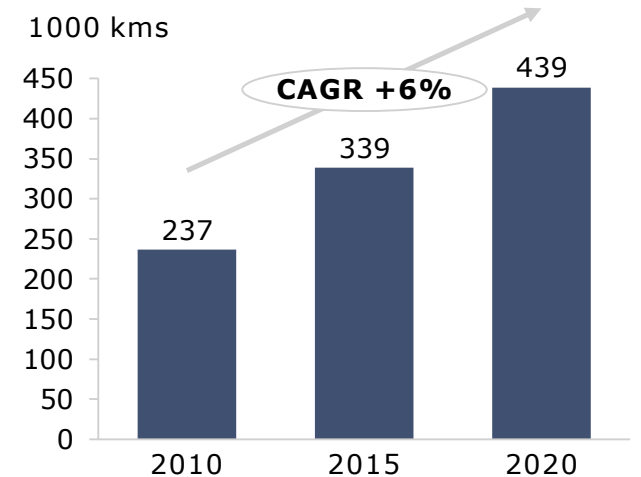
Electricity Demand (TWh) 2010-2020



Power Mix 2010-2020



Transmission capacity 2010 -2020



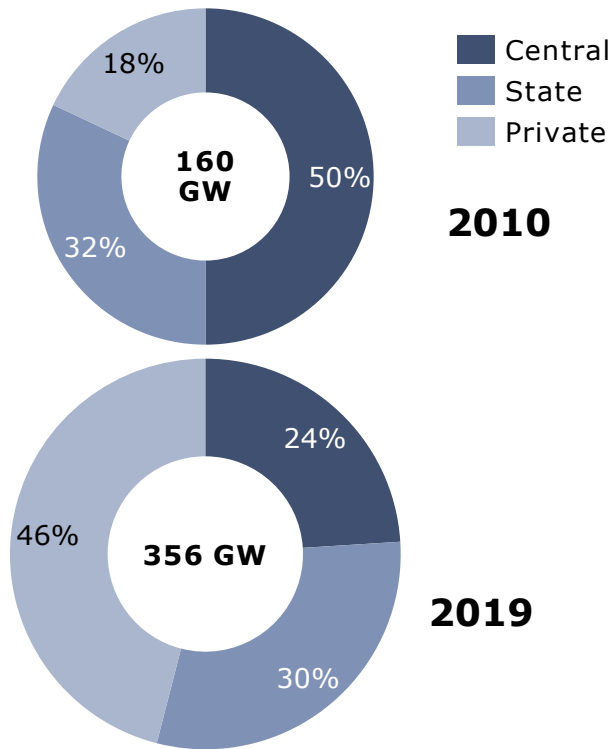
- 5 regional grids
- One single synchronously connected power system

Note: All data displayed at the end of financial year, i.e. 2010 refers to 31.3.2010
Source: Central Electricity Authority, Ministry of Power

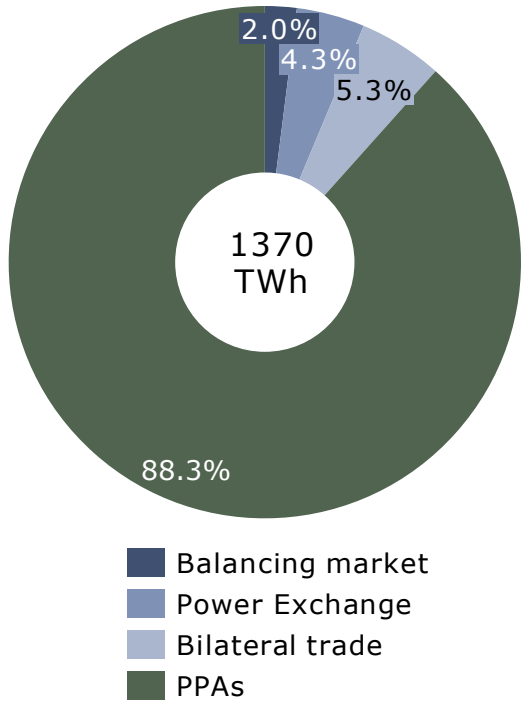
PHYSICAL POWER MARKET OUTLOOK FOR INDIA: HISTORICAL TRENDS

Private investment in the sector has increased, backed by State Government PPAs, complemented by European-style traded markets

Investments in power capacity



Power procurement 2019



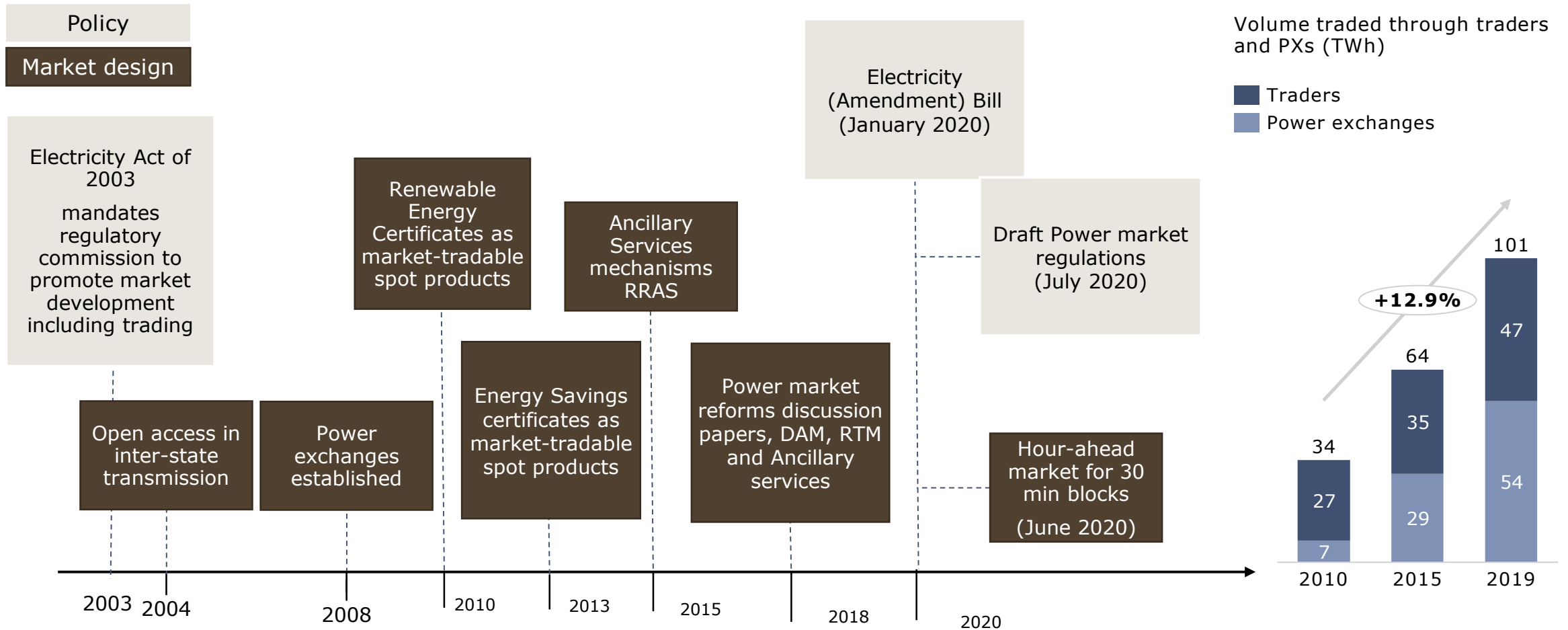
Spot power market



- Single country-wide market with 13 price zones
- European style market design
- 2 power exchanges

Note: All data displayed at the end of financial year. i.e. 2010 refers to 31.3.2010
Source: Central Electricity Authority, Ministry of Power, IEX

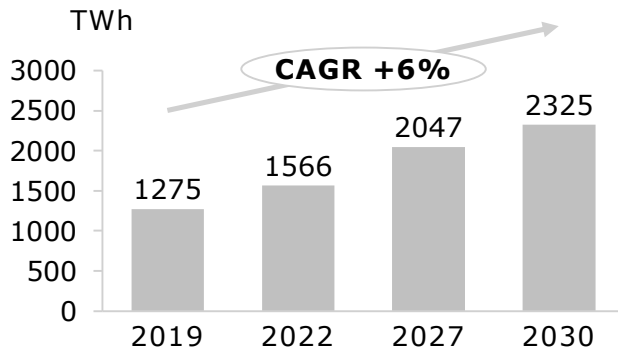
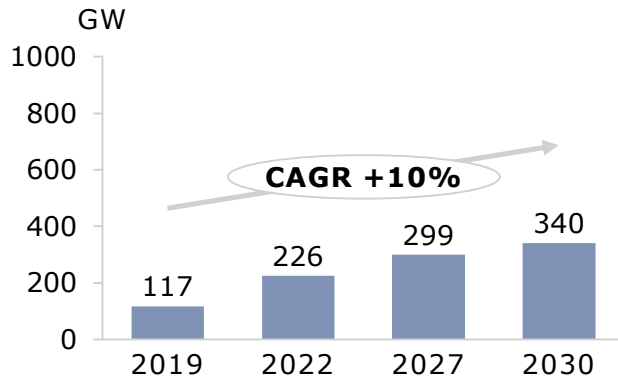
The spot markets are growing in importance from a low base, and reforms are underway to improve efficiency and liquidity



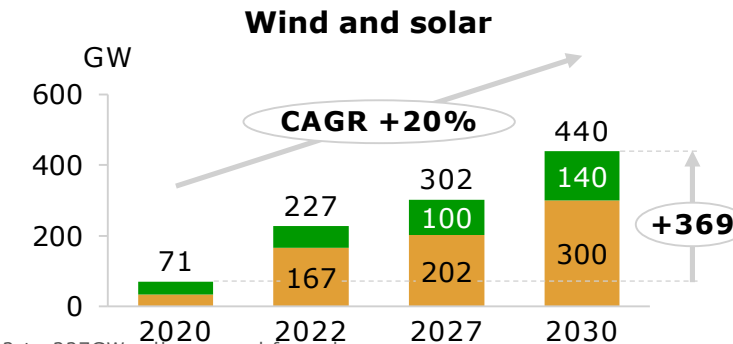
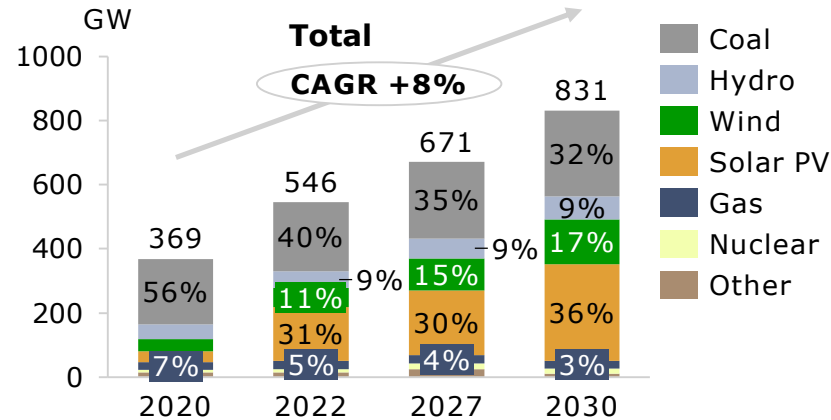
Source: CERC report on short-term market 2018-2019

By 2030 renewable share of generation capacity is expected to grow to 63%, bringing a need for flexibility in spot market timeframes

Electricity demand growth



Installed capacity future¹ (GW)



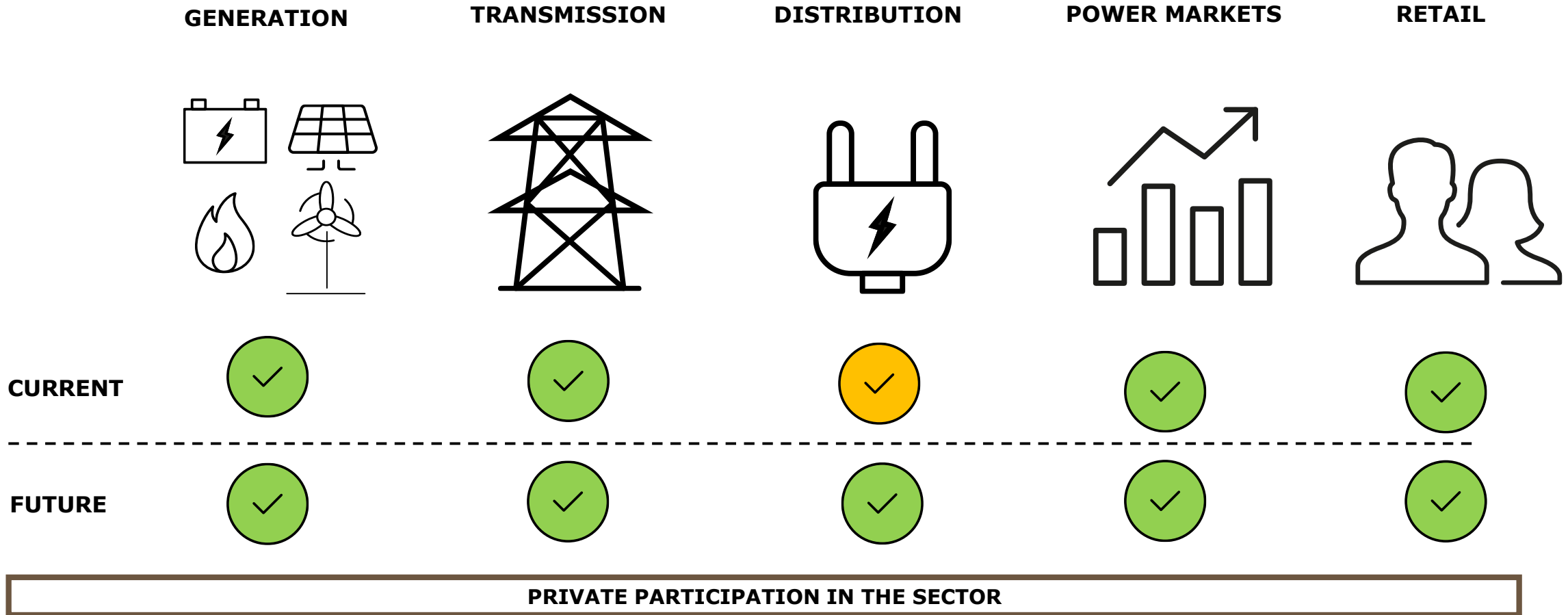
Key Messages

- 23GW of coal retires by 2022 but close to 50GW capacity already under construction - locked in PPAs
- 30-50GW annual growth in wind and solar for the next decade to meet targets and demand growth
- Increasing share of renewables will bring a growing need for flexibility
- Merchant development of generation capacity is currently non-existent
- Regulations are shaping the future market design to enhance liquidity and efficiency of dispatch

Notes: 2022 considers updated to renewable target from 175GW in 2022 to 227GW, all assumed for solar

Source: National Electricity Plan, 2018; 2030 - Optimal generation mix - CEA, 2019

Private sector has a strong presence across the value chain and private participation is expected to continue



Source: AFRY expert opinion



Vision for the Indian power market

The Government's 2024 Vision is for electricity to underpin wide-ranging strategic goals, and so policy intervention in the power sector will continue



Key objectives

Consumer Centricity

- *Customers can meet their needs and participate as they choose*

Ease of doing business

- *Markets cater for diverse needs*

Ease of living

- *Affordability and reliability*
- *Retailers manage complexity and risk on behalf of customers*

Employment creation

- *Avoid barriers to RES deployment*

Socio-economic empowerment

- *Accommodating micro scale investments and participation*

International influence

- *Trading with neighbours*
- *Designing markets for India, not derivative of others*



Strategic themes

Sustainability

- *Market outcomes are compatible with exploitation of renewable energy*

Viability

- *Market outcomes support investment in the necessary technologies*

Efficiency

- *All technologies are used effectively according to cost and capability to meet system needs*

Competitiveness

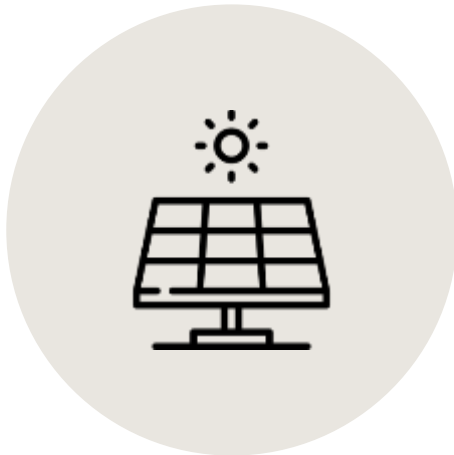
- *Market outcomes deliver efficient outcomes*

Technology focus

- *Trading arrangements must be suitable for a range of technologies*

Note: Italics indicate AFRY interpretation

The migration to the renewables-led Indian power system brings four primary challenges



RENEWABLE GRID INTEGRATION

The integration of renewables to the Indian power system, technically and commercially



TRANSFORMING ROLES

Adapting the roles of market actors to maximise participation and diversity



PROMOTING INVESTMENT

Ensuring efficient investment in the appropriate mix of generation and grid development



CUSTOMER FOCUS

Focus on the changing needs of the customer and support their empowerment



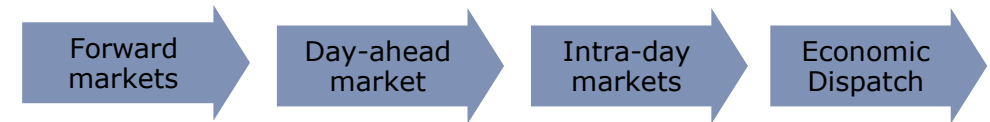
Spot markets must be adapted further for flexibility services, and network capacity should be allocated between markets, times and products

RENEWABLE GRID INTEGRATION REQUIRES A COMBINATION OF MEASURES

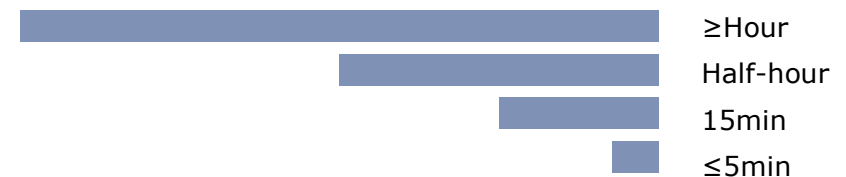
- Enhanced balancing incentives
- Improved liquidity including from PPA contracted generation
- Markets to reward flexibility
- Effective use of network capacity
- Commercial value for ancillary services
- New providers of balancing services including storage and demand side response

MARKETS SHOULD ALLOW EFFICIENT MATCHING OF BUYERS AND SELLERS ACROSS MULTIPLE TIME FRAMES

Combination of auctions and continuous markets...



Time-frame of tradable blocks must change...



Pricing methodology to suit the marketplace...

Pay-as-clear



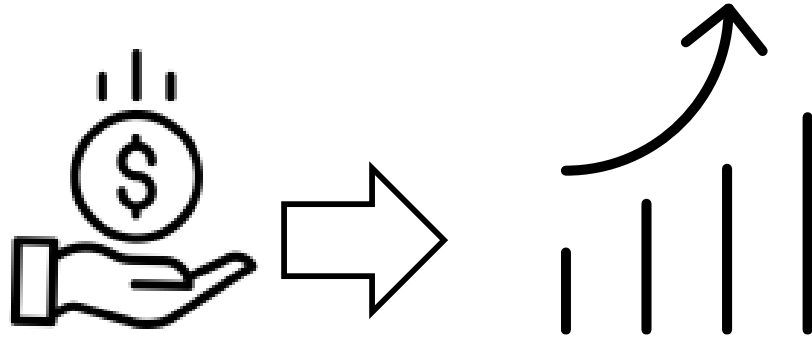
Pay-as-bid





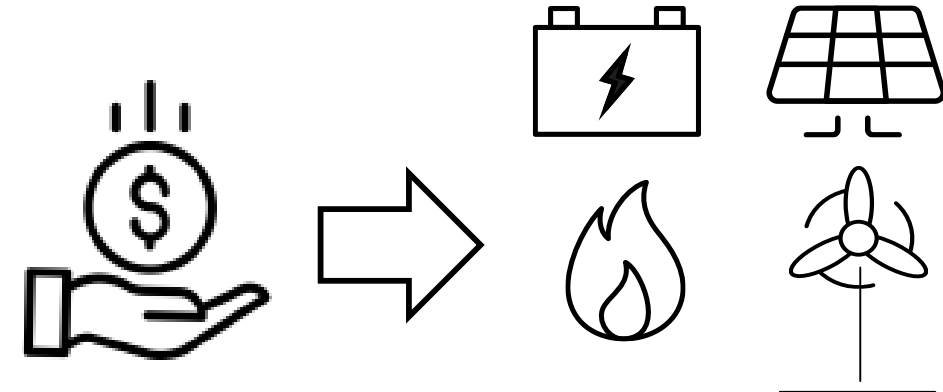
The power markets should be financially self-supporting

THERE MUST BE MARKET INCENTIVES FOR INVESTMENT



- Market prices and forward contracts should permit investment, ideally without further intervention
- A well functioning market with active demand side participation interventions such as the capacity mechanism are not required
- Any centrally sponsored contracts or bidding regulations should not undermine merchant (un-contracted) capacity or distort market outcomes

THE MARKET SHOULD SUPPORT INVESTMENT IN THE TYPES OF TECHNOLOGY WHICH ARE NEEDED



- With the growth of renewables, there will be new flexibility needs which vary by timeframe and by location
- In future, providers will include batteries and demand response, pumped storage and flexible hydro, and also more flexible coal units
- There should also be incentives to improve flexibility of existing capacity as well as for new build



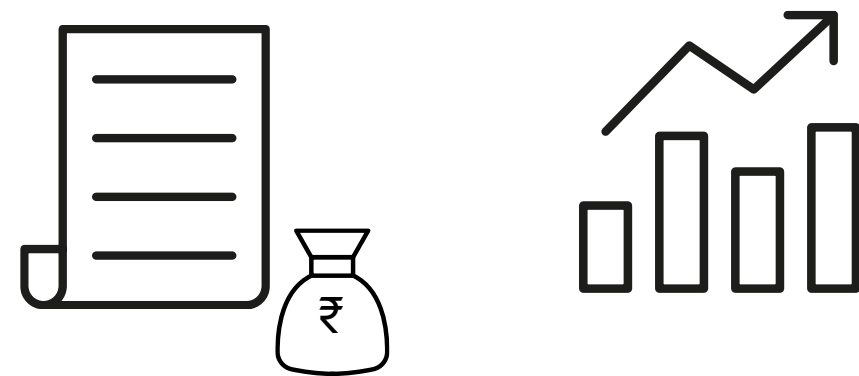
PPAs should support both spot and forward market arrangements

FLEXIBILITY IS NEEDED FROM EXISTING PPAS



- The existing PPAs have underpinned a wave of private investment and this success story must not be threatened
- Existing rights and commercial position must be respected
- Flexibility should be attained in the PPAs so that they support efficient dispatch, market liquidity and price discovery

FUTURE PPAS SHOULD COMPLEMENT MARKET ARRANGEMENTS



- Future PPAs must be directly designed around interaction with the spot markets
- PPA structures should not undermine merchant investments or destroy liquidity in the various market timeframes
- Future PPAs could be financial or physical
- The long term PPA markets should not distort spot (and other) markets for new capacity

The future Indian power sector will be vibrant and diverse

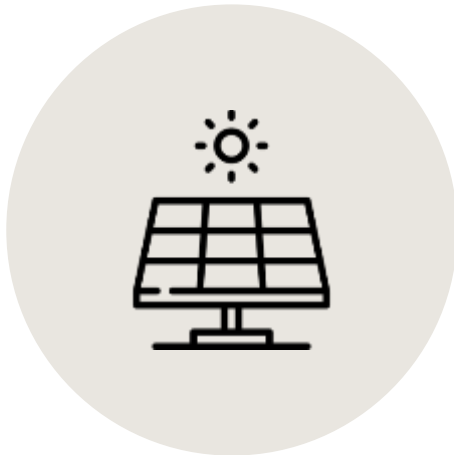
- The Government of India's vision for the 2024 power system is clearly defined in the Five Year Vision of 2019:

"A sustainable, viable, efficient and competitive power sector catalysing economic and social development"

- The Government's vision is complemented by the Electricity (Amendment) Bill of 2020 focusing on
 - Promotion of renewables,
 - Greater private participation in Distribution,
 - Commitment to introduce retail competition.
- By 2030¹, India plans a power system with 523GW of renewables, growing to over 63% of total capacity
 - in line with the 'Make in India' policy
 - supported by Green Energy Corridors
- Demand will grow +50% by 2030 and customer needs will change driven by strong economic growth, new types of electrical demand (e.g. EVs) and the 'Power for all' programme for universal access
- Renewable power development will cover a range of technologies and scale of installations, including Solar Cities
- The marketplaces and trading formats must match the needs and capabilities of a wide range of new actors and technologies
- Flexibility must come from existing capacity as well as new dedicated capacity, and demand side management using both active and 'passive' participation models

Our vision is consistent with that of the Government of India. The vision requires innovation and diversity in marketplaces and participation models, to maximise the system contribution of all available resources

Our vision for Indian power market design addresses the primary challenges



RENEWABLE GRID INTEGRATION

Spot markets must be adapted to allow efficient dispatch and for flexibility to be rewarded in many market timeframes



TRANSFORMING ROLES

Migrating to a market-led system rather than attempting central control of an increasingly diverse resource mix



PROMOTING INVESTMENT

Ensuring that investment can be delivered through market incentives, with PPAs taking a lesser role.
Existing and new PPAs to be integrated with spot markets



CUSTOMER FOCUS

Encouraging participation from many actors, including small scale generation and demand side participation

CONCLUDING REMARKS

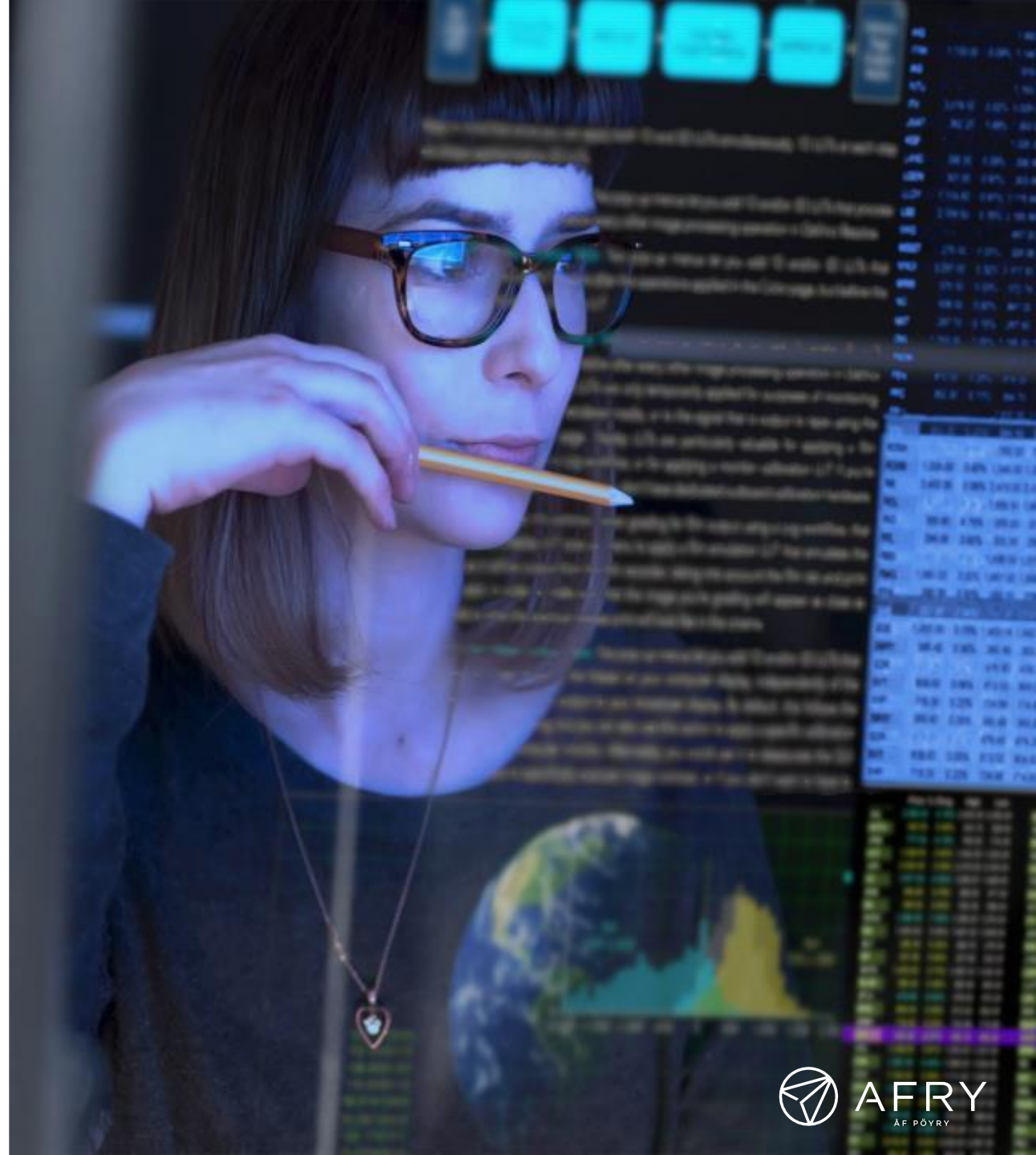
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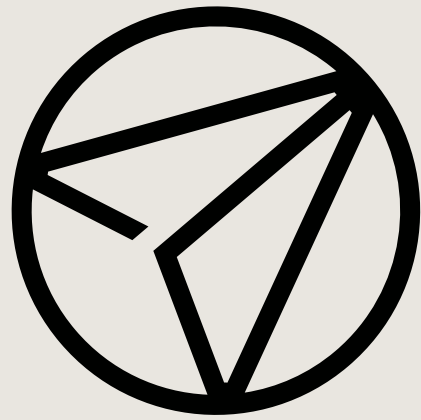
- **Reach out** to us for more information:
 - stephen.woodhouse@afry.com
 - shweta.jadhav@afry.com
- **More webinars** will follow with relevant topics, and any update on the evolving situation.
- Next webinar:

Utilities' digital transformation: a case study

Thursday 6th August
2pm BST / 3pm CEST

Sign up





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