

World Economic Forum

In collaboration with Accenture

Shaping the Future of Energy and Materials
System Value Framework and Analysis Summary
October 2020



System Value of the clean energy transition

The System Value framework more holistically evaluates economic, environmental, social and technical outcomes of potential energy solutions across markets. The framework aims to **shift political and commercial focus beyond cost to include value**.

Using the System Value framework, the World Economic Forum, supported by Accenture, conducted analysis across several geographies as part of market evaluations that examined recovery opportunities to accelerate economic growth and the clean energy transition.

The flexible nature of the framework allows inclusion of both quantitative and qualitative analysis. The relevance of System Value dimensions may vary by geography and over time horizons.



Testing System Value with market solutions

Solutions were selected, in consultation with 25+ participating companies and 50+ global stakeholders, that deliver the **most impactful** outcomes per market **to accelerate economic growth and the clean energy transition** on a 2025 or 2030 horizon.

For further detail on each market, please see subsequent executive summary slides.



Brazil



87% Renewables
9% Variable



90+ Mt Cumulative CO₂
Emissions through 2025

**Non-Hydro
Renewables
Expansion**

**Digitalization of
Transmission and
Distribution**

**Smart and
Efficient
Cities**



India



21% Renewables
10% Variable



550+ Mt Cumulative CO₂
Emissions through 2025

**Renewable Energy
Zones**

**Distributed
Solar**

**Transmission
Investment**

**Efficiency
Investment**

**Coal Plant
Closures**



China



29% Renewables
8% Variable



660+ Mt Cumulative CO₂
Emissions through 2025

**Utility-Scale
Wind and Solar**

**Distributed
Energy**

**Internet of
Energy**

**Efficiency
Investment**

**Transport and Industrial
Electrification**



South Africa



7% Renewables
5% Variable

**Grid and
Operational
Upgrades**

**Renewables
Growth through
FDI**

**Repurpose of Coal
Plants**

**Distributed
Solar**

**Efficiency and Energy
Management**



Europe



39% Renewables
16% Variable



*2,000+ Mt Cumulative CO₂
Emissions through 2030

**Connected Cities
and Electrification**

**Renewables, Power Markets and
Networks of the Future**

**Hydrogen
Economy**

*European analysis was conducted on a 2030 horizon to match Next Generation EU, with other markets focused on 2025.



United States



19% Renewables
11% Variable



520+ Mt Cumulative CO₂
Emissions through 2025

**Renewables
Expansion**

**Transmission
Investment**

**Efficiency
Investment**

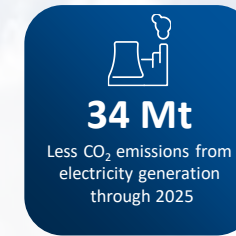
**Electrification and
Demand Optimization**

Brazil recovery solutions

Solutions to deliver power sector modernization

Non-Hydro Renewables Expansion

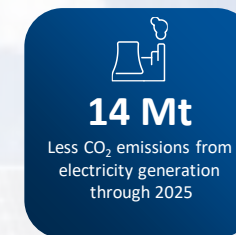
Accelerate non-hydro renewables expansion (~7 GW wind and solar) through multiple initiatives such as fostering the liberalized market (ACL) with **innovative power purchase agreements (PPAs)**, **developing a new structured solution for the Energy Reallocation Mechanism (MRE)**, and **fossil thermo-plant substitution**.



Note: Above CO₂ and human health benefit figures represent cumulative, incremental savings in addition to 2025 base case projections.

Digitalization of Transmission and Distribution (T&D)

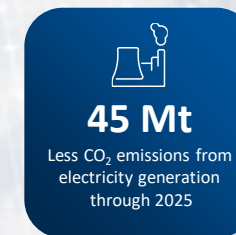
Address reliability and power quality issues through foundational **distribution network investments**, then digitize and modernize Brazil's grid through **smart grids**, **smart meters**, **internet of things (IoT)** and **distributed energy resources (DER)**.



Note: Above CO₂ and human health benefit figures represent cumulative, incremental savings in addition to 2025 base case projections. Estimated job potential based on US figures, adjusted for population.

Smart and Efficient Cities

Invest in smart cities via development of a **digital energy network**, enabling **energy efficiency and new business models** to support **distributed generation**, DERs and electric mobility, as well as public services such as **public lighting and vegetation management**.



Note: Above CO₂ and human health benefit figures represent cumulative, incremental savings in addition to 2025 base case projections. Estimated job potential based on US figures, adjusted for population.

China recovery solutions

Solutions to deliver peak emissions before 2030

Utility-scale Wind and Solar

New utility-scale solar and wind capacity growth (incremental +282 GW wind, +173 GW solar by 2025) and **cost competitiveness** are boosted by falling levelized cost of energy (LCOE) of variable renewables alongside **government mandated renewable share target**.

Distributed Energy

Distributed energy is set to nearly triple over the next five years (incremental +138 GW distributed solar by 2025) as urbanization continues, costs fall, and subsidies support distributed and rooftop solar.

Internet of Energy

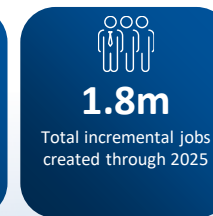
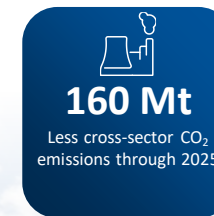
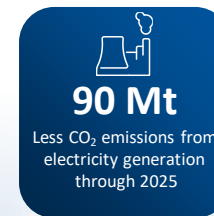
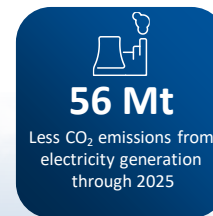
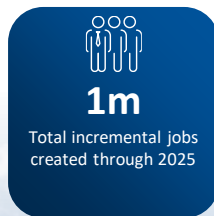
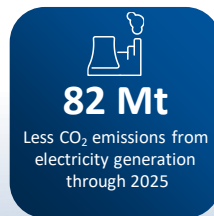
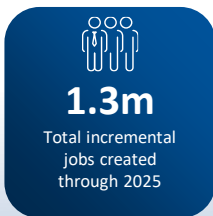
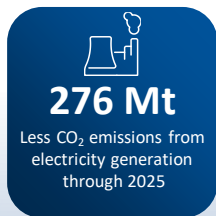
Continuous digital transformation of the power grid promotes **smart grid** developments and eventually the construction of a new digital energy ecosystem – **the Internet of Energy**.

Efficiency Investment

Efficiency opportunities across the value chain such as **grid, buildings, and industrial energy efficiency** can reduce load, driven by government energy saving policies.

Transport and Industrial Electrification

For transport, accelerate the construction of **charging infrastructure** and ongoing **electric vehicle (EV) purchasing subsidies**. For industry, continue to transform and **electrify manufacturing processes**.



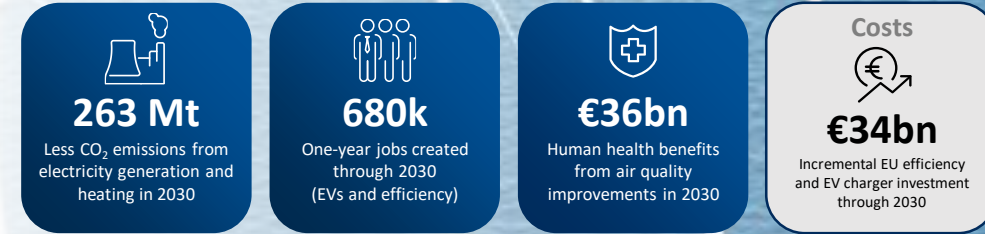
Note: Above CO₂ and human health benefit figures represent cumulative, incremental savings through 2025 compared to 2025 baseline.

Europe recovery solutions

Solutions to deliver the 2030 ambition

Connected Cities and Electrification

To continue decarbonizing Europe's cities, increase efficiency of power use and distributed energy resources, leverage **digitalization** and **demand optimization** for greater **smart flexibility**, and accelerate **electrification** through transition to **e-mobility** and **decarbonized heating systems**.



Note: Above CO₂ and human health benefit figures represent incremental savings in addition to 2030 base case projections.

Renewables, Power Markets and Networks of the Future

Transform grids, networks and power markets to support increased variable renewable and distributed resources, enabling a grid with **55%-60% share of wind and solar by 2030** and **>70% renewables**.

By 2030, variable renewables will power a larger share of transport, heating and industrial applications, which currently are not electrified.



Note: Above CO₂ and human health benefit figures represent incremental savings in addition to 2030 base case projections.

Hydrogen Economy

Build a **green hydrogen** market and infrastructure to enable cost-effective bulk hydrogen transport, storage of renewable energy and **decarbonization of Europe's 3,000 industrial clusters** (representing 54 million jobs).



Note: Emissions reduction from bringing industrial emissions to zero by 2050.

India recovery solutions

Solutions to accelerate renewables investment

Renewable Energy Zones

Accelerate utility-scale wind and solar (incremental +9 GW wind, +12 GW solar by 2025) through developing **renewable energy zones** that would take a **proactive approach to transmission** planning, thereby **lowering the project risks for developers**.

Distributed Solar

Speed growth of the Indian distributed solar sector (incremental +6 GW solar by 2025) through **establishment of public-private partnerships** and **KPI-based incentives for states**.

Transmission Investment

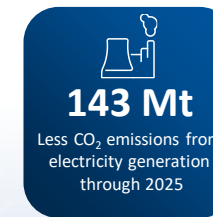
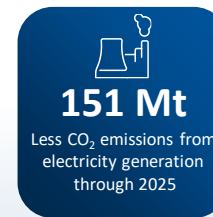
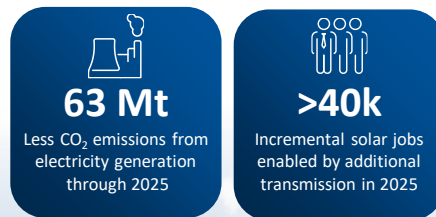
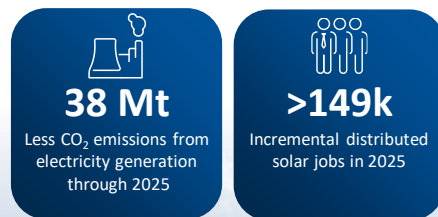
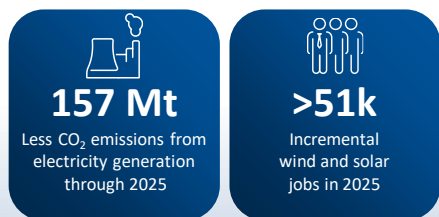
Invest in vital transmission infrastructure through **privatization efforts, renewable energy zones** and **acceleration of existing opportunities such as green energy corridors**.

Efficiency Investment

Bolster efficiency through **improvements to air conditioning, agricultural pumps, industrial efficiency and building standards**, while increasing focus on reducing transmission and distribution losses.

Coal Plant Closures

Accelerating coal plant retirement for sites that are considered financially and operationally “stressed” would lead to 41% incremental increase over current planned closures by 2025.



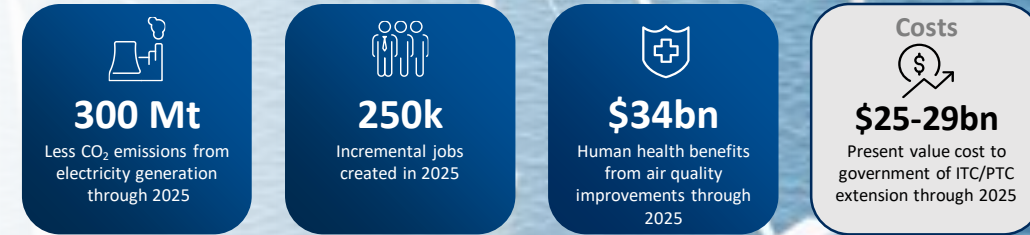
Note: Above CO₂ and human health benefit figures represent cumulative, incremental savings in addition to 2025 base case projections.

United States recovery solutions

Solutions to improve resiliency

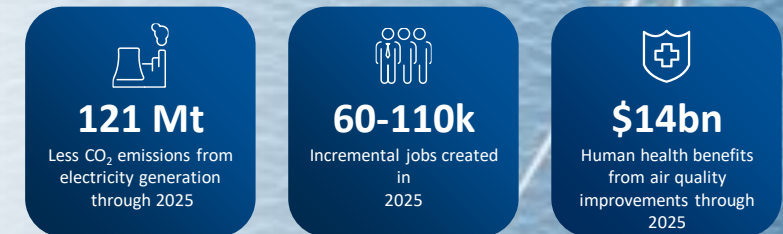
Renewables Expansion

Proposed **multi-year extensions of the investment tax credit (ITC) and production tax credit (PTC)** could increase **solar** capacity by 25% (+33 GW) and **onshore wind** by 14% (+22 GW) over 2025 base case projections, with additional ITC, process and infrastructure support able to expand the nascent **offshore wind** industry (+11 GW).



Transmission Investment

Potential to increase renewable deployment, wind capacity by 11% (+18 GW) and solar by 2% (+3 GW) in 2025, through **transmission expansion, interconnection and reinforcement**.



Efficiency Investment

Replicating the investment level of the 2009 US Recovery Act, the US could achieve efficiency gains through implementing **smart buildings and energy infrastructure**, keeping energy costs low for consumers.



Electrification and Demand Optimization

Greater support for **battery storage systems, road transport electrification and electric heat pumps** can boost system flexibility and reliability while cutting emissions.



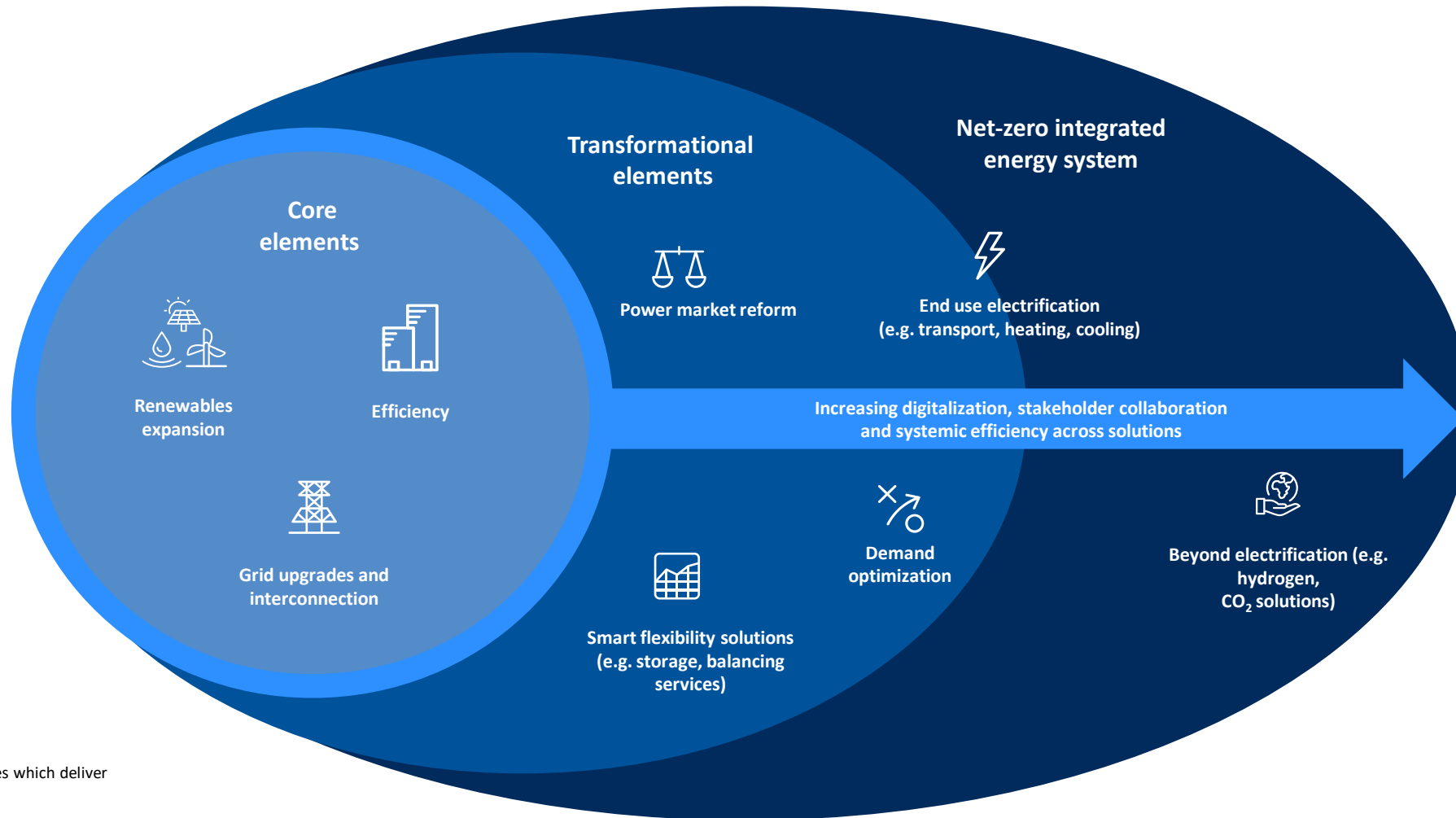
Note: Above CO₂ and human health benefit figures represent cumulative, incremental savings in addition to 2025 base case projections.

Path to maximize System Value

Markets are moving from addressing **core elements** of the electricity sector transition...

...through “**pivot points**” where generation mix hits **20-30% annual variable renewables (>50% instantaneous)** and **transformational elements** enable...

...acceleration to a **net-zero integrated energy system** with a strong focus on systemic efficiency



Note: Icons represent solution types which deliver System Value outcomes

Key insights along the path

Path summary



The expansion of renewables, grid upgrades and interconnections, and efficiency are core elements – these solutions remain essential throughout the path to an integrated energy system.



As markets transition to 20-30% annual variable renewables (>50% instantaneous) in the electricity generation mix, policy must take an integrated approach, instead of viewing supply and demand in isolation.



Getting to net zero in transport, industry and heating **requires an integrated energy system, supported by strategic linking of energy sectors, systemic efficiency and high levels of clean electrification.**



Systemic efficiency is more than just reducing load and losses, it is optimizing synergies between (and within) supply and demand, leveraging digital technologies and avoiding additional capacity investments.

Additional insights



Net-zero industrial consumption needs significant green generation and grid buildout, combined with CO₂ solutions. Renewables alone would need to more than double to meet the energy need of industrials (electrification, green hydrogen) in a net-zero system.



Energy security is no longer solely about oil and gas imports/exports, with cyber and natural disaster events increasing. Renewables, interconnections, increased diversity of sources, storage, aggregators and supply chains will contribute more to energy security.



Hydropower and natural gas can be accelerators for variable renewables by providing grid flexibility services and seasonal storage.



With the right policies in place, technology and financing will not be the barriers hindering net-zero goals. Greater stakeholder collaboration can improve administrative and regulatory processes such as permitting (e.g. offshore wind).