

Capital Market Day 2022

Innovation

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Our focus

Providing Siemens Energy with the innovations to succeed in a dynamic market



Innovation in **Service and new Fields of Action (FoA)**



Active Portfolio Management with **clear R&D KPIs** to **quickly and rigorously** stop activities that are not progressing



Investments linked to business cases with **tangible payback**



Consolidating competences in four global **Innovation Centers** for higher efficiency and more **customer proximity**



Innovating together with partners to **reduce R&D expenditures, risks** as well as to **shorten time-to-market**

Key facts and figures


R&D net spending

 ~€1.2bn¹

Employees in R&D

 4,900²


Patents

 24,200³

Business impact

 >>8%⁴
Adj. EBITA margin

Key R&D partners

 10 of the top 25 world-ranked universities⁵
22 Start-ups (external / internal)

External Recognition

- 
- **+9** in IP Ranking⁶ (#21)
 - **Frost & Sullivan** Asia-Pacific Best Practices Awards
 - **ADIPEC** Innovation Award

¹ FY21 (incl. SGRE) | ² Average number in FY21 | ³ Status: September 30,2021 | ⁴ Target for all new R&D programs by 2025 | ⁵ QS World University Rankings by Subject 2022: Engineering & Technology | ⁶ Patent Index 2021 of the European Patent Office

Holistic set of KPIs in place to track progress

R&D KPIs for Gas & Power

R&D Intensity (as % of revenue)¹

R&D related to Service¹

R&D related to Fields of Action

R&D co-development with partners²

On-Time-Delivery of Sales Release³

Proposals for Intellectual Property⁴

FY21 Actuals

FY23 Aspiration

4.5%

<4.0%

~ 40%

~ 50%

<5%

>25%

15%

>20%

95%

>95%

0.86 per €m R&D

>1 per €m R&D

¹ Based on R&D net | ² Total project volume with external funding portion | ³ Milestones “for Sales Release” of key projects | ⁴ Includes Invention Disclosures for patents, designs, etc.

Innovation efforts focused on both mid- & long-term technologies

Established Technologies

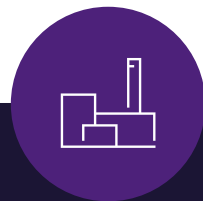
(relevant today in the market)

- Gas Power Plants
- Wind Power Plants
- Solar Power Plants
- Hydro
- Nuclear (Fission)
- Transmission & Distribution
- Compression
- Geo-Thermal
- ...

Fields of Action

(piloting & scaling)

Decarbonized Heat & Industrial Processes



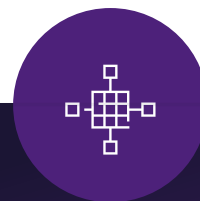
> 10%

Power-to-X



> 50%

Resilient Grids and Reliability



> 60%

Condition-based Service Interventions



> 20%

Energy Storage



> 15%

Market CAGR (2020 - 2030)¹

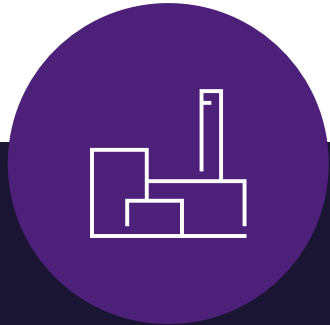
Early-stage Development

(prototyping & proof-of-concept)

- Redox Flow Batteries
- Direct Air Capture
- CO₂-electrolyzer
- Nuclear (Fusion)
- ...

Focused set of technologies identified within each Field of Action

Decarb. Heat & Industrial Processes



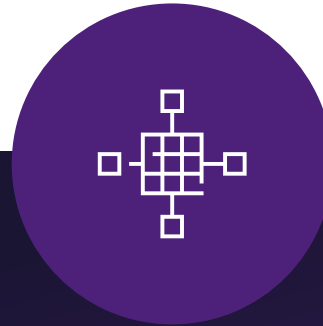
- High temperature heat pumps
- Fuel cells
- Industrial waste heat recovery

Power-to-X



- Offshore hydrogen
- Direct air capture
- E-chemicals / fuels

Resilient Grids and Reliability



- ARESS¹
- Grid automation
- Sens-X²
- Remote operations services

Condition- based Service Interventions



- Digital twins for
 - Energy consumption
 - Autonomous operation
 - Reliability
 - Microgrids

Energy Storage



- Li-ion batteries
- Long duration Energy storage
- Redox flow

Portfolio approach addresses short-/mid-/long-term technology development

Characteristics

Short-term

- Next 1 - 2 years
- Technology exists
- Market / business models established

Mid-term

- In 3 - 5 years
- Technology pilots
- Market or business models visible, but not established

Long-term

- In more than 5 years
- Technology still under development
- High uncertainty in market or business models

Selected Technologies

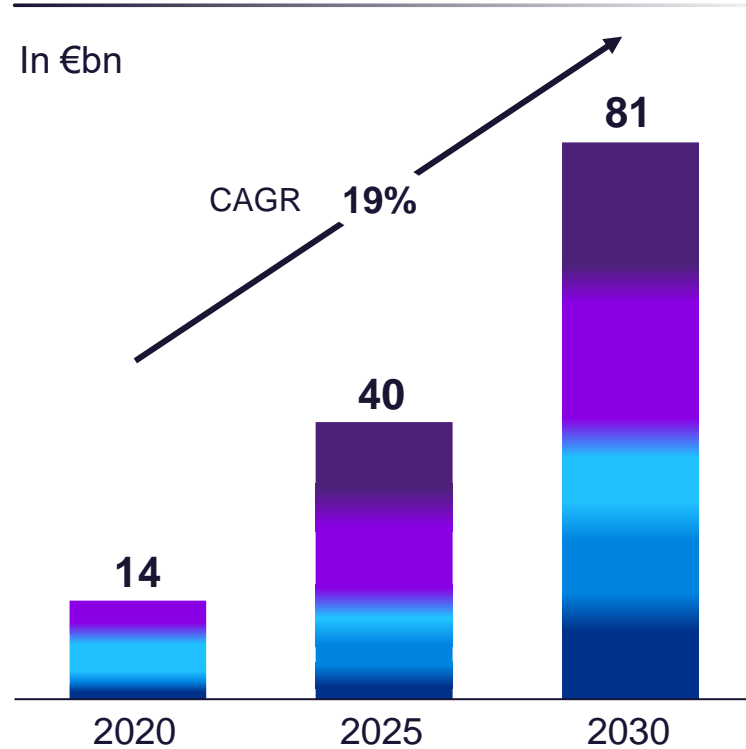
- Industrial **heat pumps**
- **Battery** energy storage
- **Asynchronous** rotating energy **system stabilizers (ARESS)**

- **Offshore hydrogen / PtX**
- Industrial **waste-heat recovery**
- Stationary **fuel cells** (MW)
- **Carbon capture** (Post-combustion)
- **Digital twins** (e.g., heat transfer)

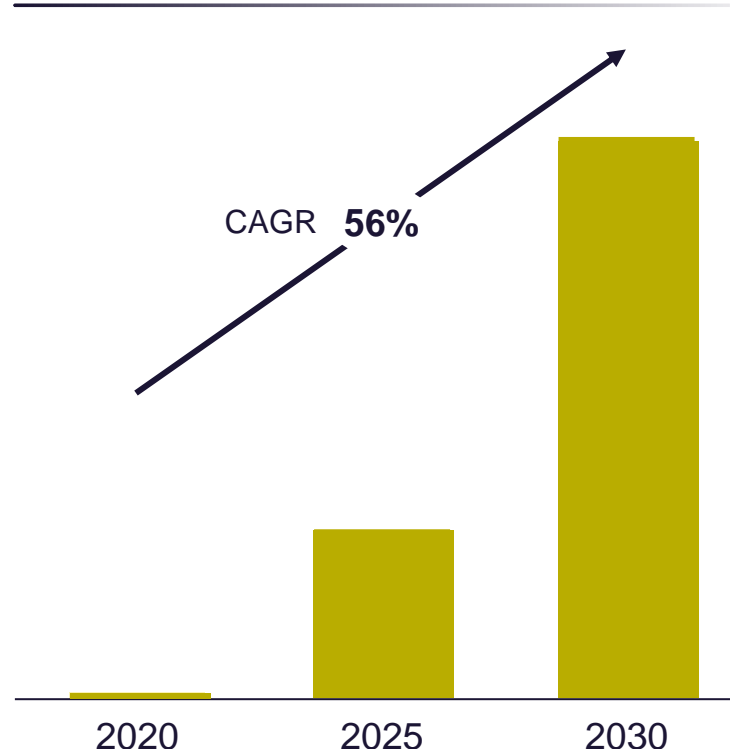
- **Direct air capture**
- **Long duration** energy storage
- Rotating **olefins cracker**

Innovation priority: Rapidly scale the five Fields of Action to generate new revenue streams

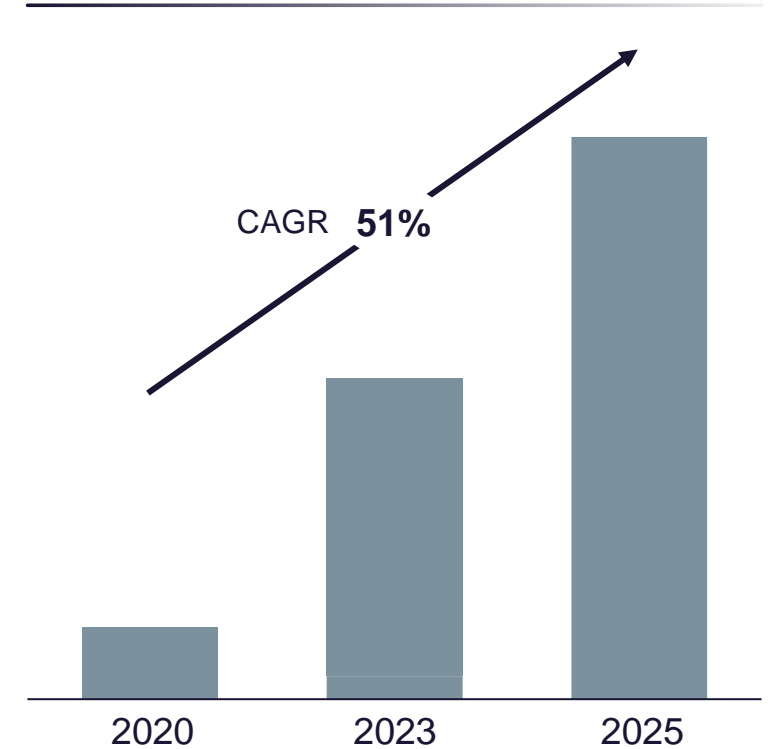
Addressable Market¹



Revenue Potential^{2,3}



R&D³



Energy Storage
 Decarb Heat & Industrial Processes
 Power to X
 Cond-based Service Interventions
 Resilient Grids and Reliability

¹ Market CAGR based on forecasts related to selected technologies within the FoA: World Energy Outlook 2019, IHS Markit Global Scenarios 2019, IEA Sustainable Development Scenario 2020 |
² Estimates by Siemens Energy of revenue that can be potentially generated based on successful project acquisition | ³ Scale of the graphs are approximate

Four Global Innovation Centers established to drive partnerships & co-creation



Co-Creation

Customer co-creation for businesses development and **new technology introduction**



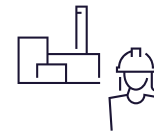
Innovation Ecosystem

Build ecosystem with start-ups, industrial partners, universities. Trend scouting



Early-Stage R&D

Develop **early-stage R&D** topics in **pre-commercial phase**



Innovation Culture

Foster innovation culture across Siemens Energy through methods, campaigns and processes



Prototyping

Develop technologies to **prototype / pilot application**; transition to the business



Communication

Communicate our innovation & ventures results **externally to stakeholders**

Partnership framework established, implemented via Innovation Centers

Accelerated innovation

Technology, industrial, university & governmental partners

Localization & market access

Strengthen regional access and localized parts for value creation

Long-term, strategic supply chain partners

Supply chain partners to improve product competitiveness

Close technology gaps and access new business models

Investments & venture “clienting” with start-ups & other companies in new technologies / business models


Selected Examples



Nvidia, AWS, Marvel Fusion



Cybersecurity Malaysia, DEWA



Faist Anlagenbau GmbH
Thyssen Krupp Electrical Steel



Aker Carbon Capture, Toray PEM

New offerings addressing decarbonization with good short-term customer pay-back

High temperature heat pump



Selected examples

Customer benefit

- **Heat supply** at large scale (up to 70MWth, up to 150°C)
- **Zero emissions** when using green energy

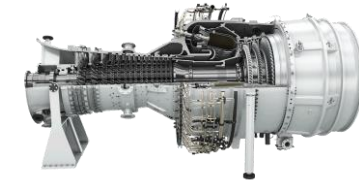
Our core competence

- Compressor technology
- System design and integration

Results delivered in past 12 months

- **Pilot with Vattenfall** at Potsdamer Platz/Berlin (8MWth / 120°C)
- **Project award** (MVV, Mannheim) of 20MWth / 7MWel heat pump

Gas turbine upgrades



- **Higher efficiencies**
- Combustion of **green fuels**
- Short-term customer payback

- Turbomachinery
- Field Service & Repair
- Additive Manufacturing

Example (F-class)

- **+1.75%-pts** efficiency,
- **~35kt p.a. CO₂ emissions, 30 vol-% H₂ content**

Future offerings enable our customers to successfully decarbonize their operations

Electrolyzer green hydrogen



Silyzer 300

Fuel cells for data centers



Selected examples

Customer benefit

- **Green hydrogen**
- Energy export
- Green hydrogen costs <2 US\$/kg¹

Our core competence

- System Design & Integration
- Electrochemistry

Results delivered in past 12 months

- **Sold >80MW** of electrolyzers
- Ramping-up **electrolyzer production** in Berlin

- **~60% electrical efficiency**
- **Replaces fossil** backup power
- **Reliable** decentral **power** supply (hybrids with batteries)

- Synergies with electrolyzers
- Large-scale energy technologies
- Global service network

- **First concept of large-scale fuel cells** for data center applications (with partner)
- Co-creation with customers

¹ Renewable electricity price <2 ct/kWh and 6,000 operating hours/year

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