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The role of smart infrastructures in the future energy system

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Siemens Smart Infrastructure

The challenge –
The energy system of the future must be …

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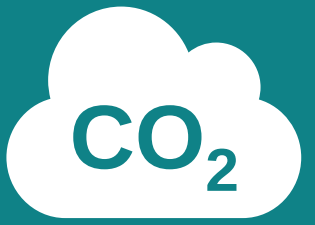
Economical

Secure



Environmentally compatible

The solution –
Direct and indirect electrification with huge potential

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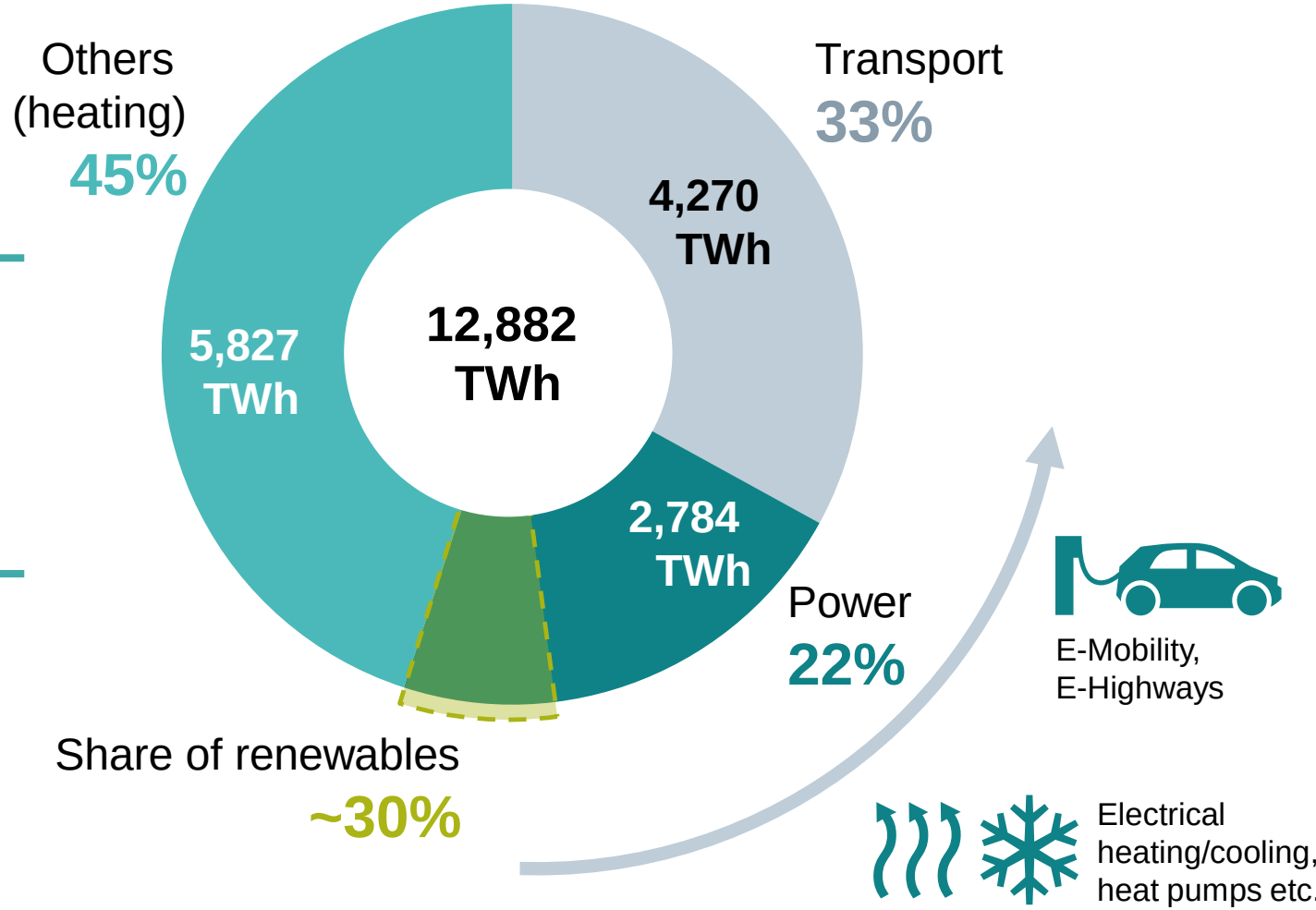
Final energy consumption EU28 in 2016



Source: eurostat

The reason –
Electric power is as versatile as no other energy carrier

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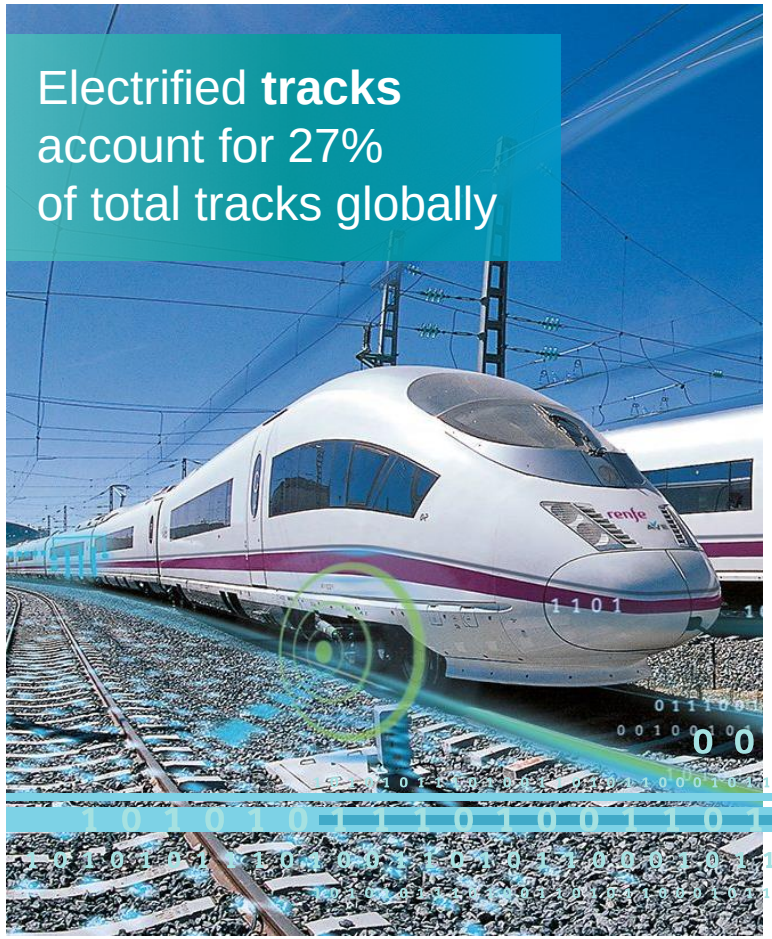
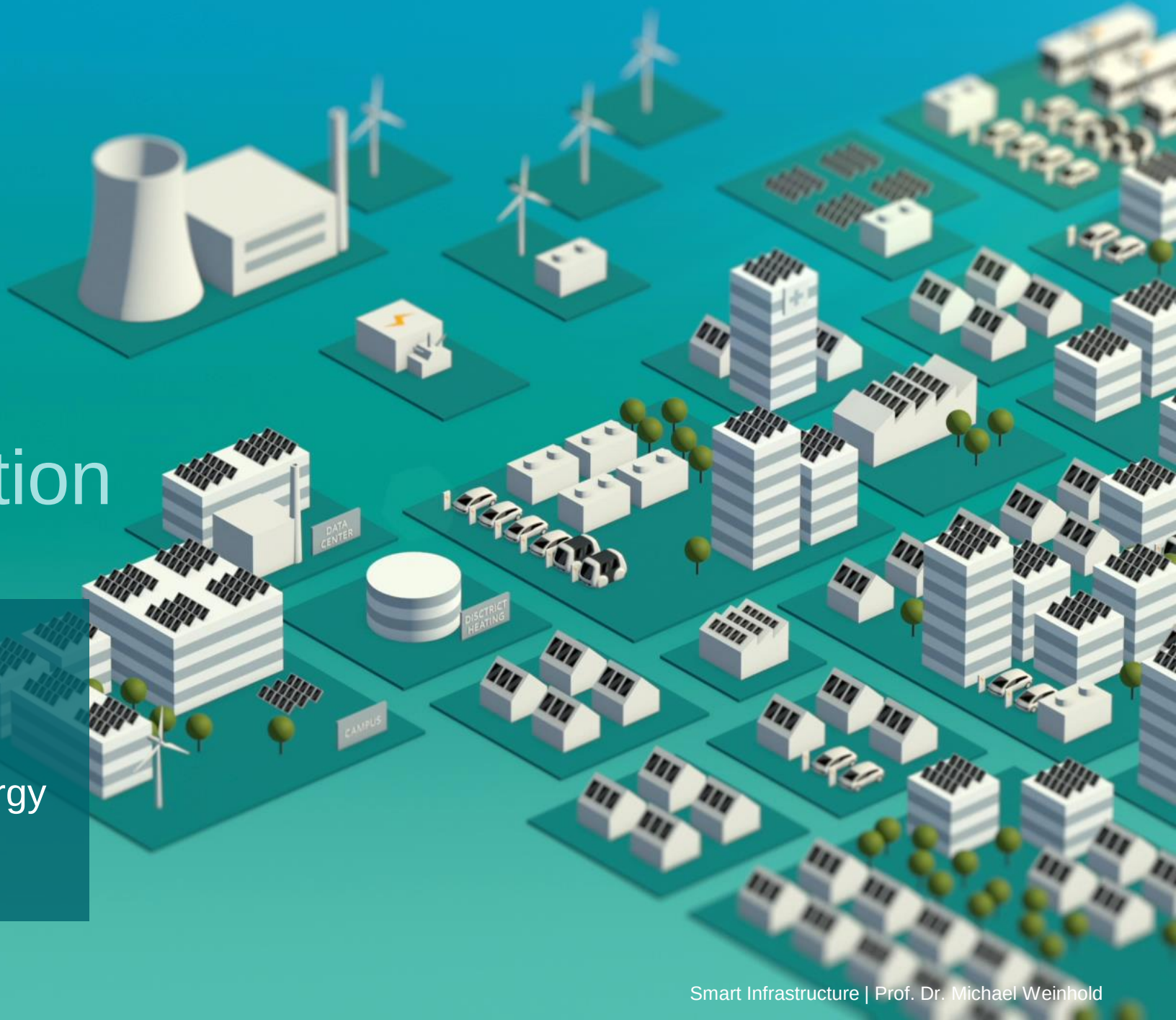


Sources: Railway Electrification Global Market Trends, IEA

The consequence – Smart infrastructure

Decarbonization and decentralization



2x
electricity consumption by 2050

>50%
renewable annual energy by 2035

The consequence – Smart infrastructure

Urbanization and sustainability

70%

of global population will live in cities by 2050

36%

of energy consumed by buildings

Enablers of the energy transformation

Holistic end-to-end energy management – Example of an industrial facility

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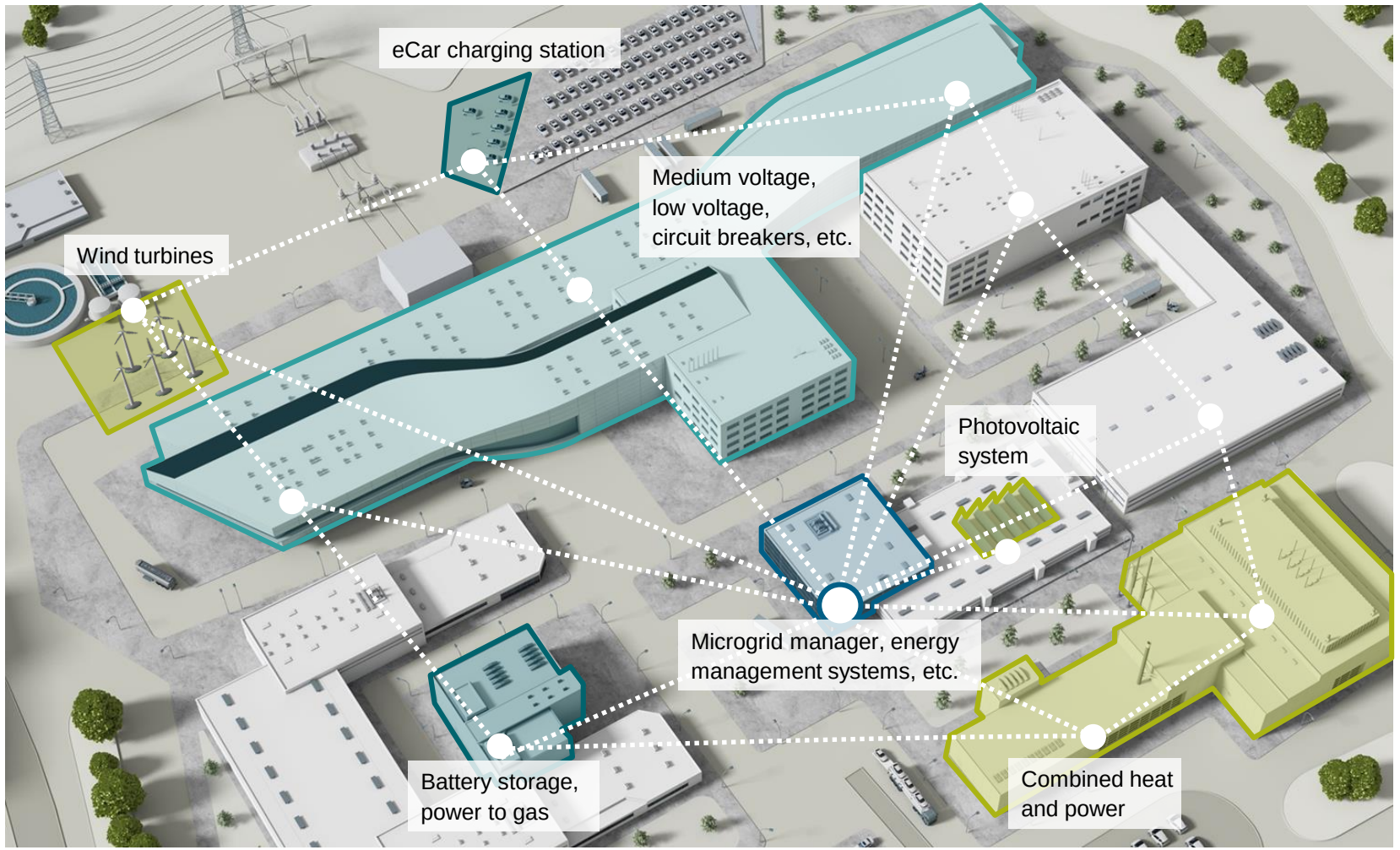

Distributed Energy Systems (DES)

- Distributed generation
- Storage solutions
- Electrical equipment and power electronics
- Energy automation and management, software

The new Siemens Campus

- Implementation of **Building Information Model (BIM)** during planning phase
- Realization of one floor as **Virtual Reality (VR)**
- **Augmented Reality (AR)** application as support during operation phase
- **Location based services**
  - “Comfy” app for employees
  - Real-time analytics via “Enlighted” IoT-sensors

Example Power Electronics (PE) – Exploring new application fields

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PE application fields

Power-to-Power

Power Generation

Wind

Photovoltaics

Transmission, Distribution, Storage

Transmission

Distribution

Stationary battery storage

Charger

Power-to-Motion

Industrial Drives

Pumps, Fans, HVAC

Discrete

Tooling Machines

Process

e-Mobility

e-Car

e-Train

Marine

e-Aircraft

Example Power Electronics (PE) – Shaping market and technology trends

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Market trends

- **Electr(on)ification**
- Distribution, decentralization
- DC infrastructures
- **Functional integration**
- Individualization
- **Short innovation cycles**

Technology trends

- **Semiconductor materials**
- **Multi core and cloud computing**
- Hybrid switches, solid state transformers
- Vertical integration
- **SW-defined functionality**
- Virtual prototyping and digital twin

Power Electronics

Siemens research and development focus (examples)

- Power Electronic systems with Software-defined, customized functionalities
- Data-driven services based on Power Electronic systems as sensors and actors
- Modular, scalable HW/SW architecture; networked PE building blocks
- Vertical integration: New materials, planar joining technologies

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What else?

Let’s take a look into the future …

Increased complexity calls for a significant change of the system control

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