


**Electra**  
**Doing Business with Energy Efficiency**  
**Thursday 15. October 2009, Ljubljana (SI)**

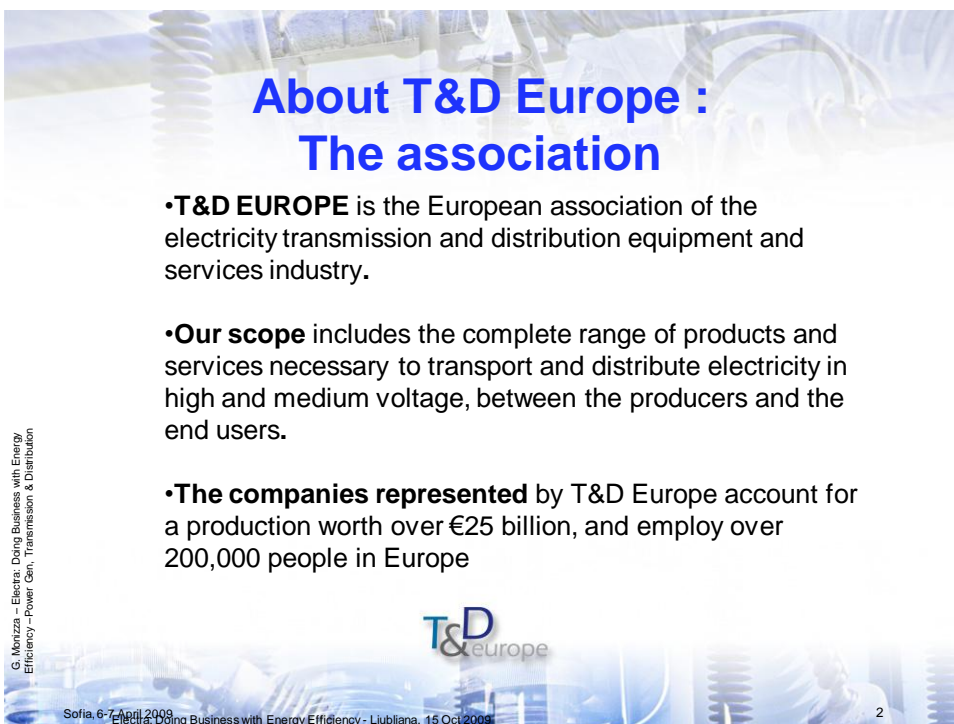
**Electra conclusions in the area of  
smart grids**

**Giuliano Monizza**




Sofia, 6-7 April 2009  
 Electra - Doing Business with Energy Efficiency - Ljubljana, 15 Oct 2009

G. Monizza - Electra: Doing Business with Energy Efficiency - Power Gen, Transmission & Distribution



**About T&D Europe :  
The association**

- **T&D EUROPE** is the European association of the electricity transmission and distribution equipment and services industry.
- **Our scope** includes the complete range of products and services necessary to transport and distribute electricity in high and medium voltage, between the producers and the end users.
- **The companies represented** by T&D Europe account for a production worth over €25 billion, and employ over 200,000 people in Europe



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## About T&D Europe : The Members

- **Members of T&D EUROPE are all relevant European national associations.**



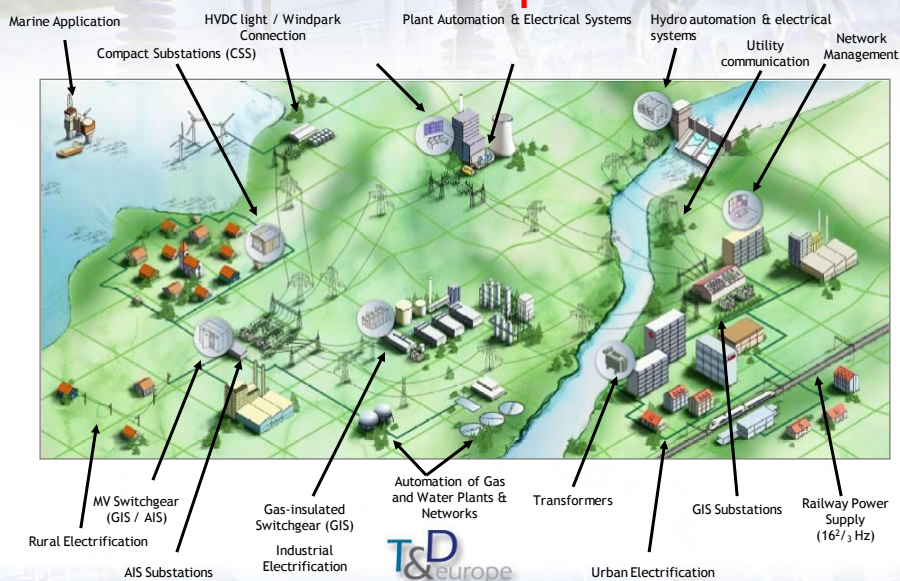
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## The world in power T&D

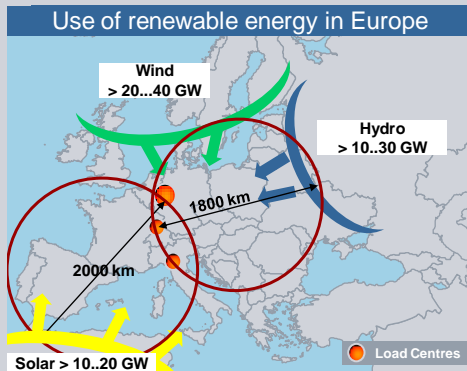


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# Grid access for large scale renewables



**T&D Products and Solutions**

- Worldwide most powerful wind energy plant mass-produced
- Complete solutions for on-shore and off-shore wind power
- Highly-efficient turbines for solarthermal power generation
- Integration of renewable energies via HVDC
- Energy lines with UHVAC and UHVDC
- Gas-insulated lines (GIL)

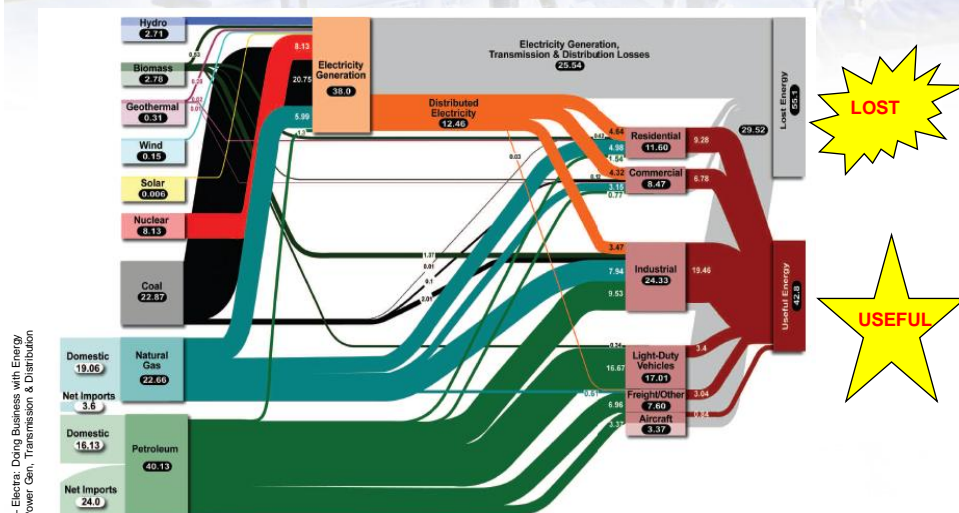
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# US Energy flows- EFFICIENCY FOCUS



Source: University of California, Lawrence Livermore Ntl Labs, DoE.  
 Units in quadrillion BTUs ("quads"); 1 quad = 10<sup>15</sup> BTU = 1.055x10<sup>18</sup>J.

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## Power Generation

- The **total world generation** of electricity :19'000 TWh in 2006  
EU25 accounted for 3'300 TWh.
- **Renewable sources: EU target= 20%**  
globally provide some 7% of the electricity generated.
- **Fossil fuels** cover 70% of worldwide electricity while in Europe the figure is 60%.
- A drastic change in the portfolio of power generation in Europe is required
- Public opinion does not accept a substantial increase in nuclear energy in some countries
- The availability of extra **hydro power** is limited.
- **Renewable energy sources**, such as **wind, solar energy, biomasses**, are expected to increase up to 10-15% of the energy supply in the short and medium term and are not yet, in most cases, economically competitive.

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## Power Generation, Transmission & Distribution

**Today's conversion systems** from primary energy to useful forms of energy are highly inefficient in many countries

**Average power generation efficiency = 33%**  
but could be higher than 50% with existing technologies.

In the EU, approximately 7% of the generated electricity is lost in the power transmission and distribution.

### Key technologies trends:

- Power plants with higher efficiency and controllability
- CCS (Carbon Capture Storage) & CHP (Combined Heat & Power): **Eff > 80%**
- Transmission and distribution grids (HVDC, Facts) , “Supergrids”,

### Transmission: T-Smartgrids

- Grid flexibility and reliability, Bulk Power Transmission, Fast change load profile, Bi- directional, ready-to-collect decentralized renewable sources

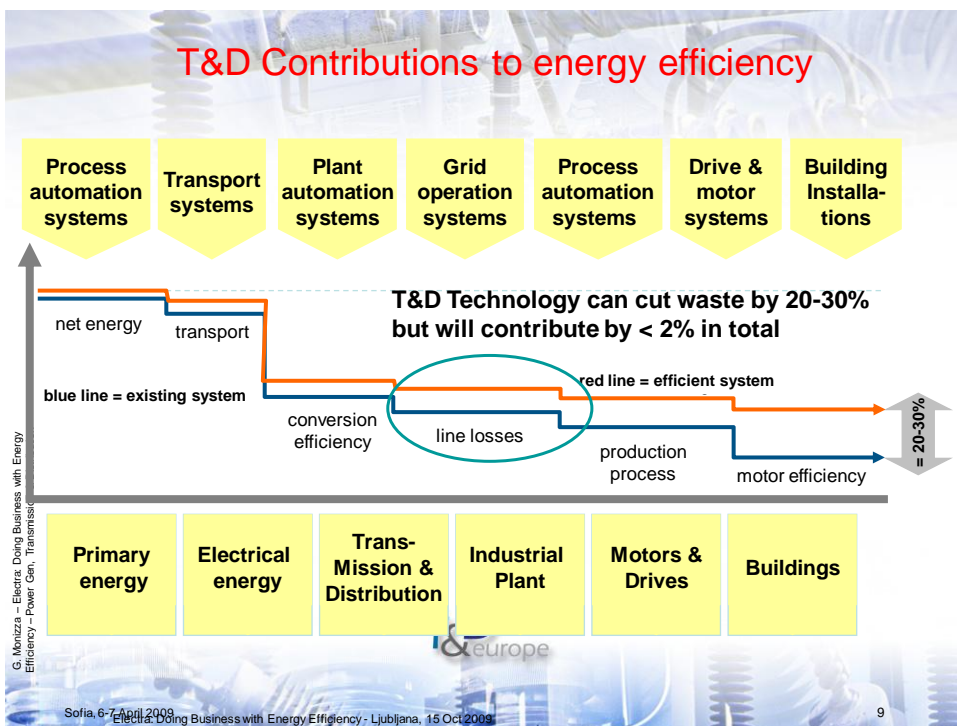
### Distribution: D-Smartgrids

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### 25% ... 30% saving potential in end-user sectors

Findings from ELECTRA report

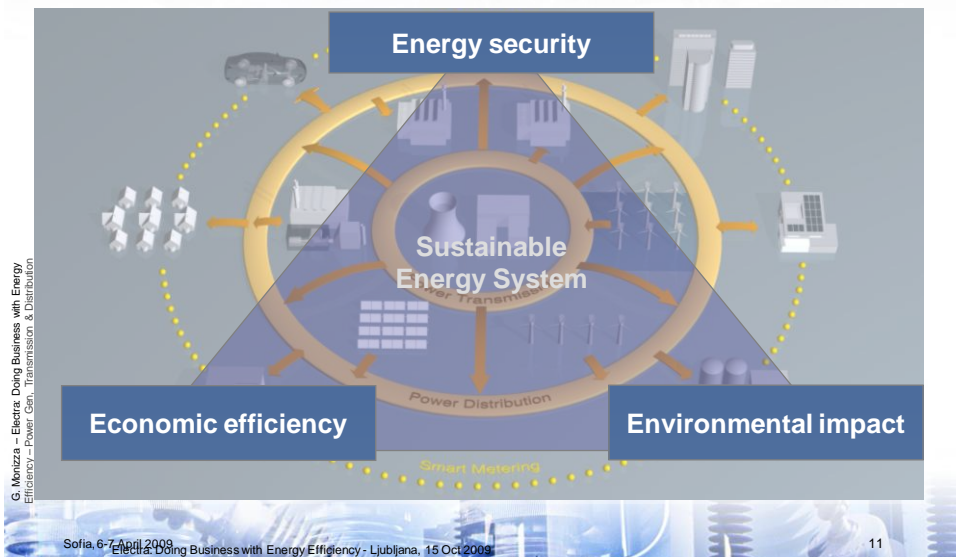
Sector	Energy consumption (Mtoe) 2005	Energy Consumption (Mtoe) 2020 (Business as usual)	Energy Saving Potential 2020 (Mtoe)	Full Energy Saving Potential 2020 (%)
Households (residential)	280	338	91	27%
Commercial buildings (Tertiary)	157	211	63	30%
Transport	332	405	105	26%
Manufacturing Industry	297	382	95	25%

*Estimates for full energy saving potential in end-use sectors*

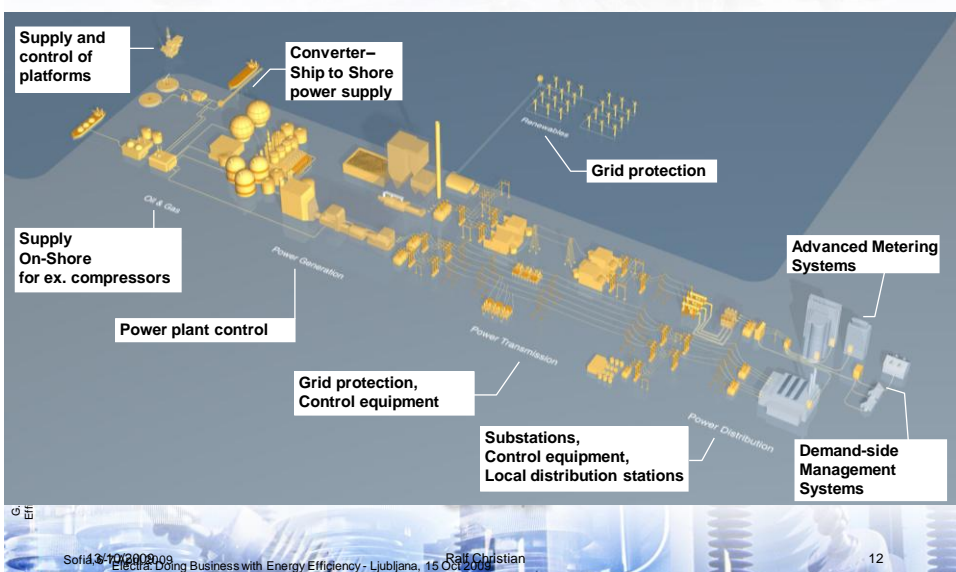
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## The 3 pillars of a sustainable energy system



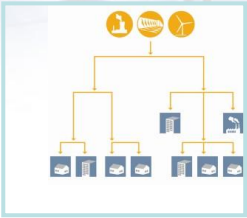
## Grid automation is an important enabler along the entire energy chain




### Smart Grids - why and what -

## From traditional to smart grids

**traditional grid**




**smart grids**



- Centralized power generation
- One-directional power flow
- Generation follows load
- Top-down operations planning
- Operation based on historical experience

- Centralized and distributed power generation
- Multi-directional power flow
- Consumption integrated in system operation
- Operation based on real-time data



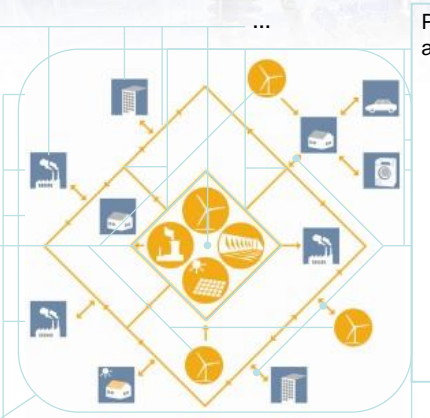
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### Smart Grids offering

## The portfolio – all over the system!

**System operation:**  
Network Manager

- [SCADA](#)
- [SCADA/EMS](#) (incl. [WAMS](#))
- [BMS](#)



**Power transmission and distribution:**

- [solutions for load flow control and power quality improvement](#)
- [substation automation](#)
- [Network Manager SCADA/DMS](#)
- [distribution and feeder automation](#)
- [distribution communication](#)

**Power generation:**

- [Network Mgr. SCADA/GMS](#)
- System for
  - thermal
  - hydro
  - solar

**Power system communication**

- [optical communication](#)
- [radio communication](#)

**Demand response**

- smart metering
- advanced home appliances

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## Smart Grids drivers

# Improving Grid Energy Efficiency

*cap bank regulator FACTS switches*

*Tap Changers*

(S) sensor (M) meter

- Goal: Loss reduction in distribution grids by controlling field devices
- How: Reduction of line current, thus resistive losses
- Financial drivers
  - Reduction of fuel burn (and emissions)
  - Reduction of generation capacity
- Solution areas
  - Improved coordination and integration
    - [integrated communication infrastructure](#)
    - [distributed generation, energy storage and demand response](#)
  - Outage support → [improved substation power factor](#)

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## Smart Grids drivers

# Improving Grid Reliability

- **Goal:** Automatic isolation and location of faults, very fast service restoration to customers
- **How:** Using information from IEDs, sensors and meters to control switchgear and to pinpoint fault location
- **Financial drivers**
  - Improved customer satisfaction
  - Avoided penalties
  - Reduction of operational expenses (e.g. crew costs, tree trimming)
- **Solution areas**
  - [Improved coordination and integration](#)
  - [Utilization of advanced metering infrastructure](#)
  - [Outage support](#)

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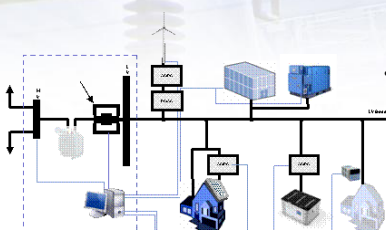
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## Smart Grids drivers

# Renewable and Distributed Generation



- **Goal:** Ensuring reliable grid operation in systems with high share of generation based on volatile renewable energy (e.g. wind and solar) and maybe economic storage

- **How (examples):**
  - Wind and PV specific protection and control systems
  - Wind and PV specific substations and power electronics
  - HVDC to connect remote wind and solar thermal plants
- **Financial drivers**
  - Emission reduction
  - Maintaining security of supply despite volatile generation
- **Solution areas**
  - Improved coordination and integration
    - **integrated communication infrastructure**
    - **distributed generation, energy storage and demand response**
  - Outage support
    - **restoration switching alternatives**
    - **peak load shifting to defer generation investments**

} *supporting Smart Grids*

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# Transmission & Distribution

## Key technologies trends

### T&D losses reduction:

- Actual average total: 6-7.5% (Transmission up to 3.5%; Dist up to 4.5%)

#### Loss reduction by:

- Voltage increase
- Reduction of reactive power transmitted
- Increase transformer efficiency
- Replace old transformers

### Substations:

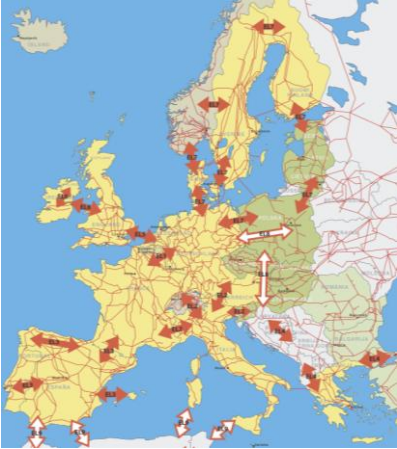
- Smaller footprint (GIS)
- Replacement of old installed base (T-Smart & D-Smart)

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## The need for more Transmission investment

Development of a Pan-European transmission grid requires investments!



### Drivers

- Rising electricity demand
- Integration and accommodation of renewable energies
- More cross-border energy trade
- High regional electricity prices
- Energy security concerns
- Stability Improvement

The UCTE countries **need** to invest **\*17 Bil. EUR** on their Transmission Network between 2008 -2013

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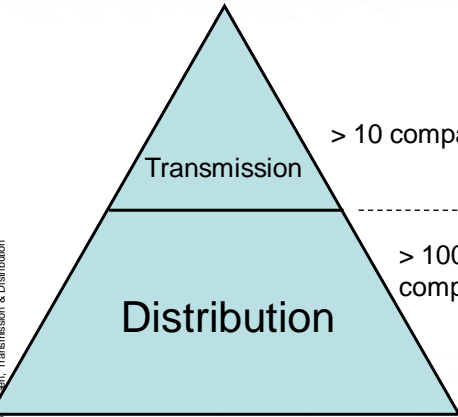
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## Structure of the current EU recovery program regarding Electricity and Wind

### T&D Industry



Transmission > 10 companies

Distribution > 1000 companies

### Effect of EU recovery program

- 750 M€ for Transmission
- A small portion of 500 M€ from Wind

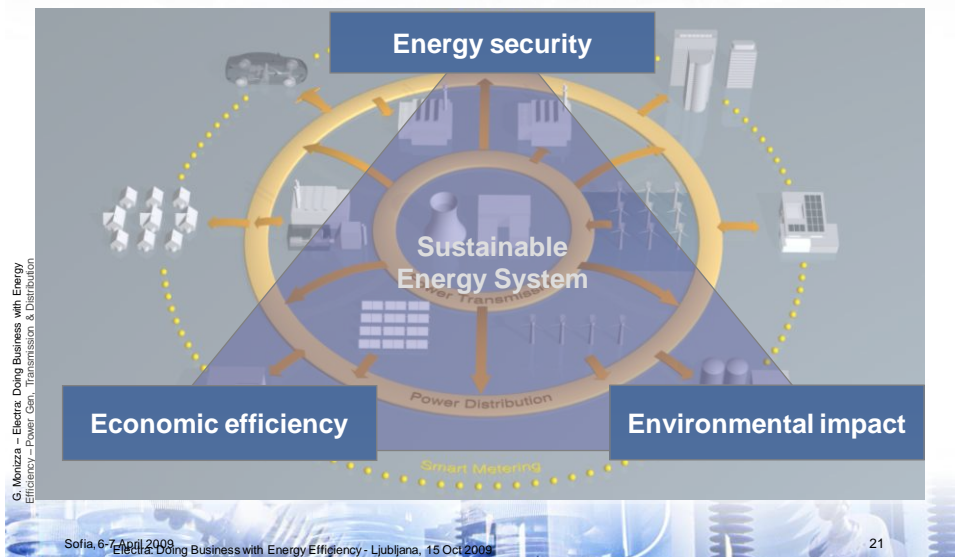
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## The 3 pillars of a sustainable energy system



## 3 forces are needed to enable the future sustainable energy system

**Climate-compatible energy technologies**  
**Efficiency increase, CO<sub>2</sub> sequestration, wind, solar thermal ...**



**Only through joint forces of politics, power sector and industry sustainable energy systems can become reality.**



## **T&D EUROPE**

**the voice that drives consensus**

**on Transmission & Distribution Technologies**

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