ACCELERATING THE ENERGY TRANSITION WITH SYSTEMS ENGINEERING

Welcome! Please do come in, and find a spot

INCOSE
International Council on Systems Engineering
The Netherlands

The **SIG ENERGY WORKSHOP** starts at 15:00hr

Workshop format

- Short introduction and problem statement
- Break-out sessions
- Plenary report out
- Wrap-up

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ACCELERATING THE ENERGY TRANSITION WITH SYSTEMS ENGINEERING

SIG ENERGY WORKSHOP
INCOSE-NL DAY, 3 OCTOBER 2024

ACCELERATING THE ENERGY TRANSITION WITH SE
WORKSHOP OBJECTIVES

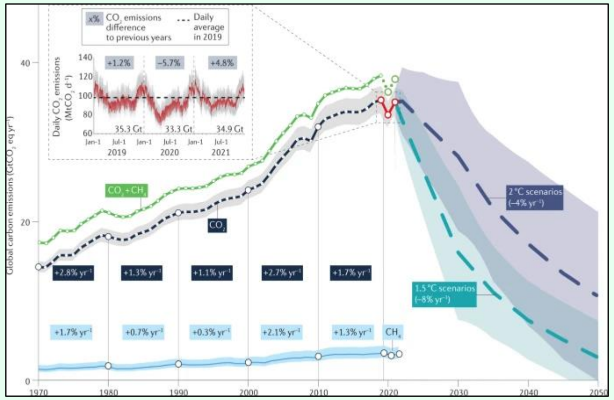
- **Identify areas** where SE can support the energy transition, in particular for:
  - Building and upgrading large quantities of mid and high-voltage stations

- **Share best practices and lessons learned** in SE for energy systems,
  - In particular for: Transmission System Operators (TSO), and
Distribution System Operators (DSO)

THE ENERGY TRANSITION

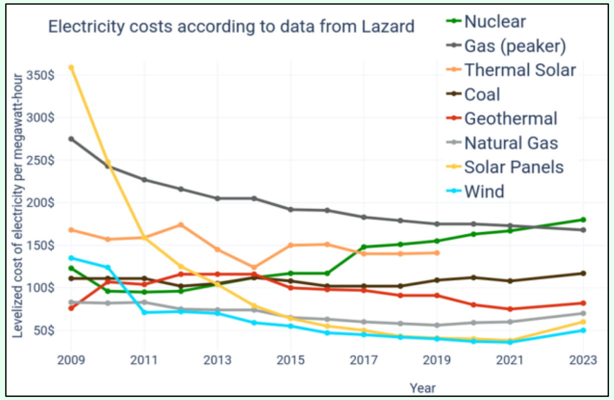
KEY DRIVERS AND THEIR CONSEQUENCES

Climate goals



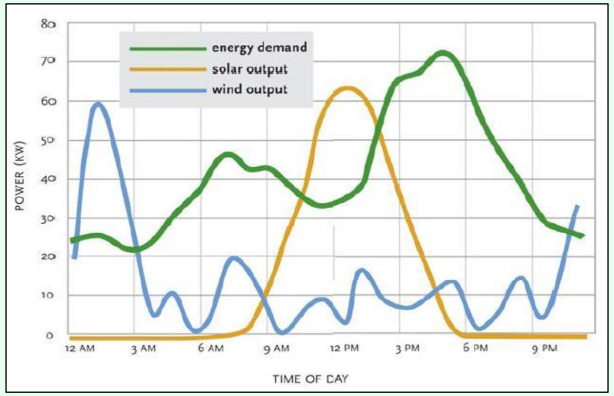
- -55% in 2030; -100% in 2050
- Phase-out fossil fuels
- Shift to renewable sources
- Efficiency increase

Economic



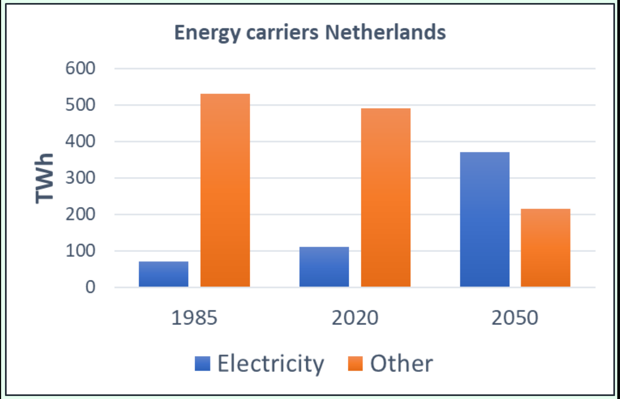
- Solar and wind now cheaper than gas or coal plants
- (Levelized cost of electricity)

Intermittent and unpredictable energy supply



- 40% electricity solar/wind in 2023; growing fast
- Demand → supply driven
- Flexibilization of energy

Massive electrification



- EV's, heatpumps, industry, …
- Up to 5x increase in electricity demand in 2050
- Smarter use of infrastructure

Unprecedented engineering effort in times of scarcity of experts and tight labor market

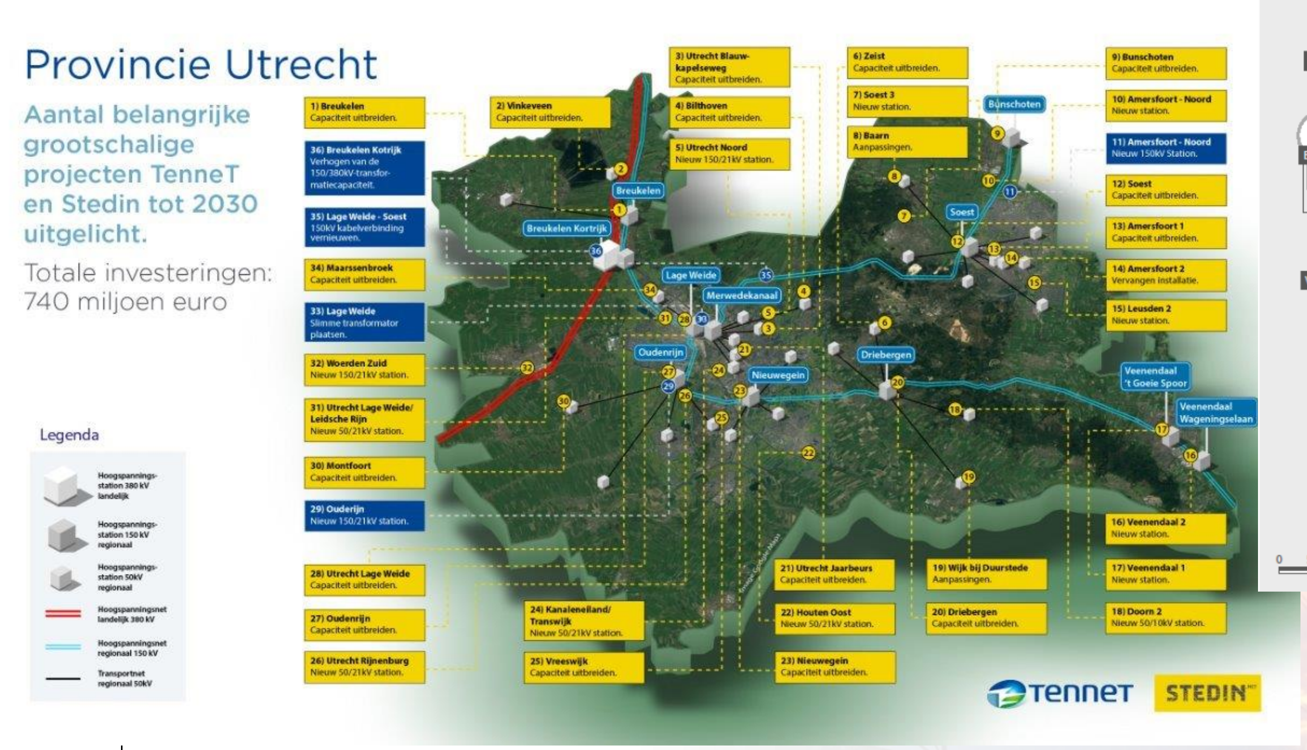
ACCELERATING THE ENERGY TRANSITION

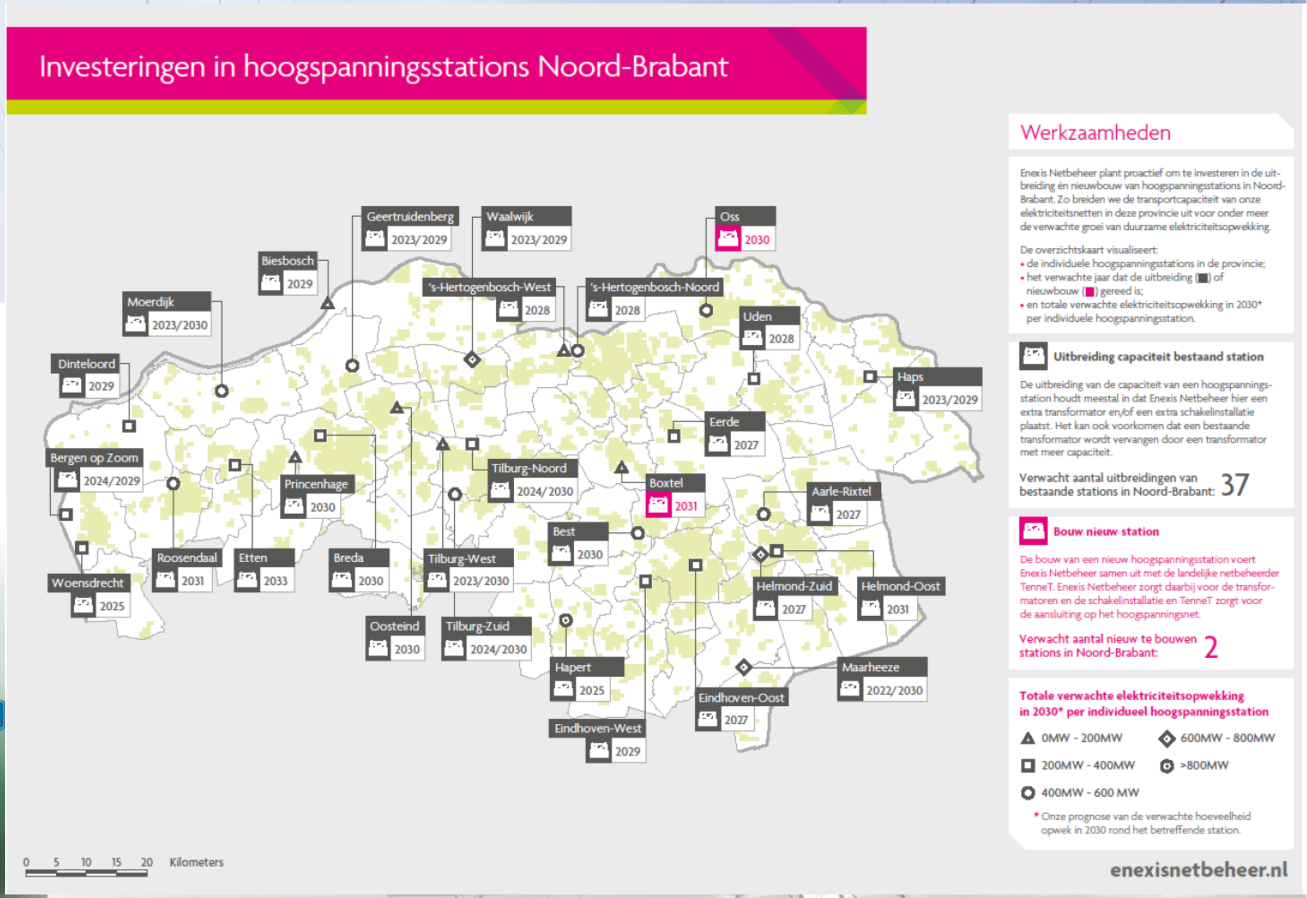
SCOPE AND CHALLENGES

- **Scope today: mid- and high-voltage stations**
  - Transportation: 10 kV and higher
  - DSO/TSOs need to upgrade/add 100’s of stations
- **The energy grid** has a long history, lots of legacy
  - Rapid upscaling NOW,
  - Coping with a shortage of personnel
- **Major upscaling challenges**
  - Building for rapid demand increase, while supply is decentralizing
  - Transport and supply of electricity must continue
  - Flex/curtailment versus meeting peak capacity → which balance?

RAPID UPSCALING OF MID- AND HIGH-VOLTAGE STATIONS

EXAMPLES: ENEXIS AND STEDIN PLANS





SIG ENERGY TRANSITION

INCOSE-NL SPECIAL INTEREST GROUP

- Discusses **Systems Engineering** contributions in context of the **Energy Transition**
- Furthers the INCOSE-NL strategy
- Seeks connection to the wider INCOSE
  - Presence planned at INCOSE IW25: Seville Spain

- SIG members include:
  - DSOs/TSOs,
  - Organizations working with the energy sector
  - Research institutes, e.g. TNO

- SIG meets monthly, chaired by Harry van de Velde

INCOSE-NL Strategy topic	Description
Socially Relevant Issues	Actively stimulate SE contributions to **Socially Relevant Issues.**
Trustworthy Authority	Develop INCOSE-NL to a **Trustworthy Authority** on all matters SE in the Dutch ecosystems leveraging international networks.
Growth	**Grow** the INCOSE-NL network in absolute membership, active domains and partnerships.
Make SE Popular	Make the SE profession more **popular** by promoting and marketing SE.
Knowledge and Products	Offer useful **knowledge and products** to improve quality of SE application.
Professionalism	Make INCOSE-NL more **professional.**

FUESSE STUDY -
FUTURE ENERGY SYSTEM SYSTEMS ENGINEERING

FuES SE

The challenges imposed by the ***energy transition*** *put a heavy societal pressure on the NL grid operators to* ***scale up*** *the capacity of the energy grid infrastructure.*

This demands ***smarter (digital) and more efficient ways to realize grid extensions*** *while keeping the existing infrastructure operational.*

FuESSE is a joint study on what the current engineering state of practice in the sector is, and explores the benefits of ***Systems Engineering (SE)*** *approaches to create more* ***synergy*** *along the grid operators' asset supply chain and between the grid operators themselves.*

TenneT — TSO

Stedin, Alliander, Enexis — DSO

TNO — Applied Research institute

FOCUS VOOR FUESSE PROJECT

FOR GRID OPERATORS, AND TNO

FuES SE

- The **main challenge of the FuESSE-project** is how to:

  mitigate the shortage of personnel

  by **accelerating the creation process, and increasing workforce productivity, of** realisation of systems (stations) and their lifecycle-management.

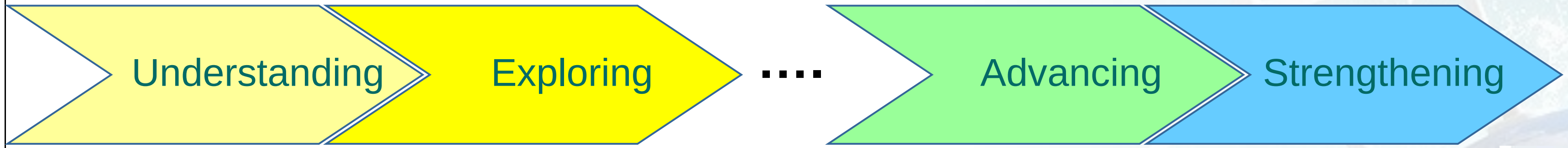
- **Shared challenges** are identified for:

  beneficial application of **Systems Engineering**

Key topics discussed

- **How to increase productivity** (by applying SE)?
- **How to align, harmonise WoW** (and SE) across organisations

FUESSE APPROACH: SCANNING AND DEEPENING
WORKSHOPS AND DEEP DIVES ON SELECTED TOPICS

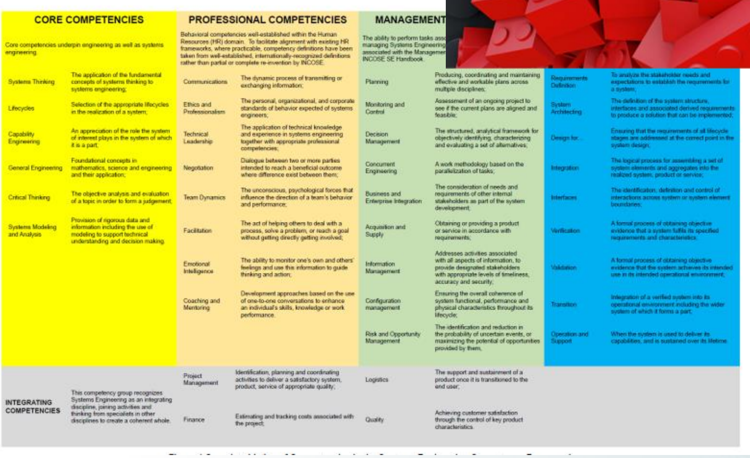


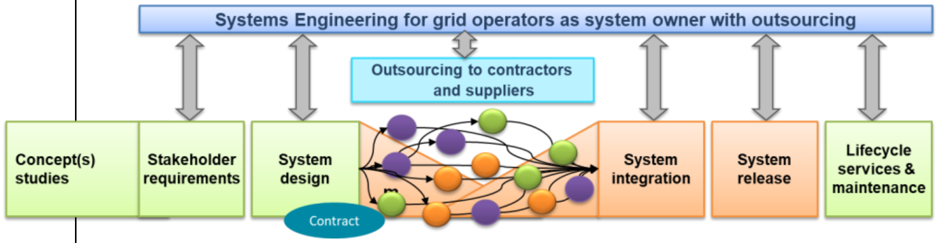
Deep dive topics so far:

- Modular building of stations
- Competencies for SE lead engineers
- Outsourcing of projects to contractors

Modulair opgebouwd: schakelstation Lelystad

Photo by Nathan Duck on Unsplash





WORKSHOP BREAK-OUT TOPICS

BUILDING AND UPGRADING LARGE QUANTITIES OF MID AND HIGH-VOLTAGE STATIONS

1. **Where, and in what role, can SE have the most impact on accelerating the energy transition, for design and construction of stations, e.g:**
   - Improve predictability of projects and quality of systems (stations)
   - Accelerate building of stations,
   - Improve collaboration / outsourcing
   - Foster innovation
2. **Which SE methodologies are most valuable for the energy transition and why?**
   - Which problems will it solve, in particular for design and construction of stations?
   - What is a success story in your own domain; how to transfer that to the energy domain?
3. **What are the biggest challenges for deploying SE in this sector?**
   - What are your lessons learned / advices to pass on to the energy sector for deploying SE?

WORKSHOP PROGRAMME

BUILDING AND UPGRADING LARGE QUANTITIES OF MID AND HIGH-VOLTAGE STATIONS

- **Select your topic/break-out group** by taking a card
- **Discuss in break-out groups** with moderator: 15:30 – 16:00 hrs
- **Plenary report out:** share key insights: 16:00 – 16:30 hrs
  - 10 minutes per group

➔ **Consolidation report** in INCOSE SIG Energy: be welcome, next session 18 Oct!

WORKSHOP BREAKOUTS

BUILDING AND UPGRADING LARGE QUANTITIES OF MID AND HIGH-VOLTAGE STATIONS

1. Where, and in what role, can SE have the most impact on accelerating the energy transition, for design and construction of stations?

2. Which SE methodologies are most valuable for the energy transition and why?

3. What are the biggest challenges for deploying SE in this sector?

WORKSHOP REPORT OUT

BUILDING AND UPGRADING LARGE QUANTITIES OF MID AND HIGH-VOLTAGE STATIONS

1. **Break-out 1 findings and insights**
   - Where, and in what role, can SE have the most impact on accelerating the energy transition, for design and construction of stations?
2. **Break-out 2 findings and insights**
   - Which SE methodologies are most valuable for the energy transition and why?
3. **Break-out 3 findings and insights**
   - What are the biggest challenges for deploying SE in this sector?

WRAP-UP: TRENDS AND NEEDS IN THE ENERGY TRANSITION

PERSPECTIVE OF GRID OPERATORS

Trends and drivers

- 1. Electricity demand increases manyfold
- 2. Rise of sustainable, yet intermittent energy sources
- 3. Scarcity of public space
- 4. Increasing political and legislative pressure
- 5. Digitalization & AI
- 6. Further integration of energy system(s)
- 7. Globalization of supply chains
- 8. Scarcity of engineering experts
- 9. Vulnerability of energy infrastructure

Grid operator (SE) needs

- 1. Build faster
- 2. Steer towards more efficient grid utilization
- 3. Increase flex capacity
- 4. Scale up asset management
- 5. Grow workforce, skills & productivity

Enablers: Digitalization of Systems Engineering | SE-competencies for the future

THANK YOU FOR YOUR CONTRIBUTIONS!

Photo by Matt Jones on Unsplash