

# The Role of Gas and Gas Infrastructure in Swedish Decarbonisation Pathways (2020-2045)

NORDION ENERGI krafringen Göteborg Energi

ÖRESUNDS  
KRAFT

gasnätet  
STOCKHOLM AB

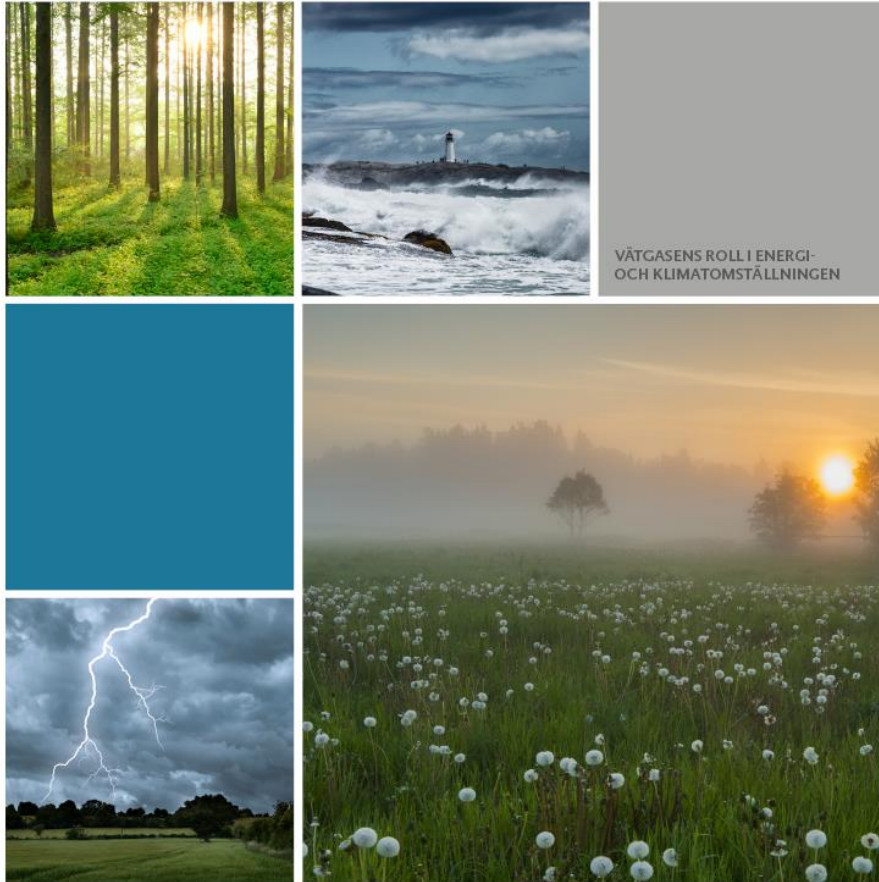
Energiforsk

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# THE ROLE OF GAS AND GAS INFRASTRUCTURE IN SWEDISH DECARBONISATION PATHWAYS 2020-2045

REPORT 2021:788



**Direct Link to Report ([here](#))**  
Link to introduction page ([here](#))


Modelling Approach

This study explores the role of gas supply and gas infrastructure in achieving a net-zero Swedish energy system by 2045

- Analysis considers 4 Swedish and 3 neighboring regions.

**Geographic Regions (x7):**

Sweden & neighboring regions



**Energy Carriers (x3):**

- Electricity
- Hydrogen
- Methane

**Seasons (x5):**

- Spring
- Summer
- Fall
- Winter
- Winter Peak

**Model Years (x6):**

2020, 2025, 2030, 2035, 2040 and 2045

**Time Granularity:**

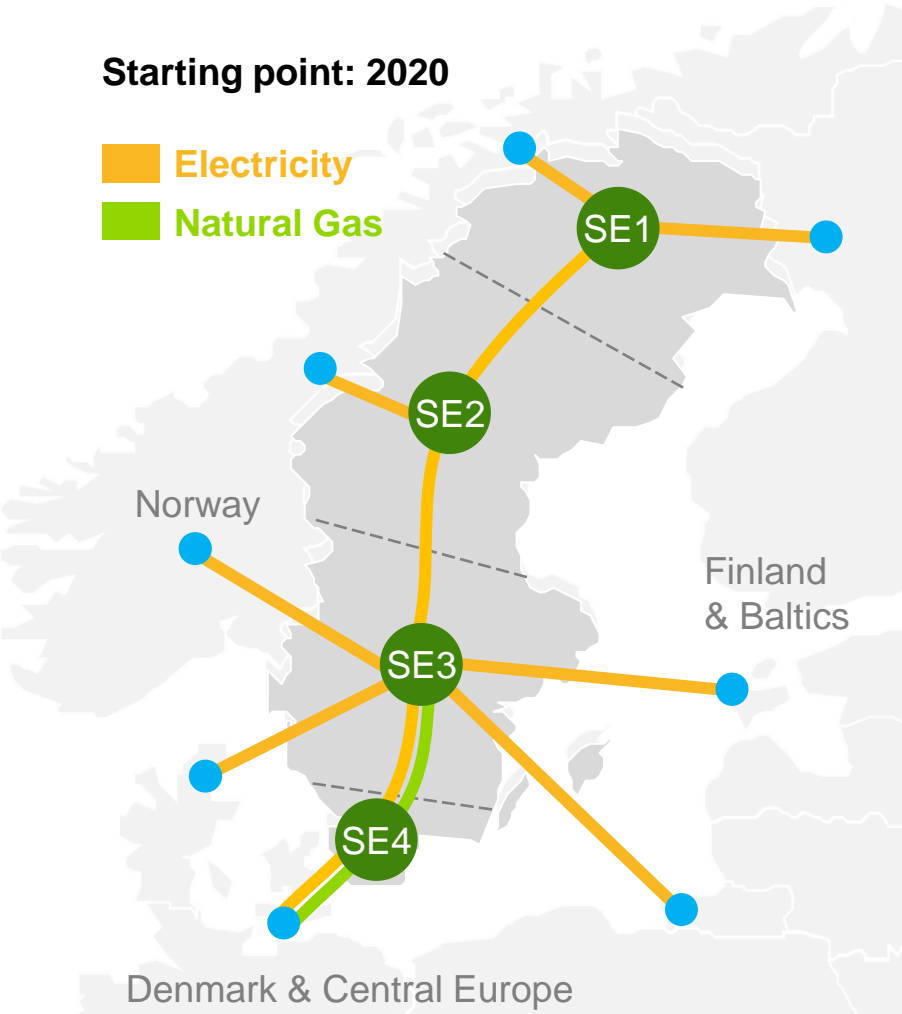
24hr profiles for each season

- Two main scenarios of 2020-2045 energy demand:

Major Role for Gas	Gas plays prominent role across industry, transport, and building heating
Limited Role for Gas	Gas plays more limited role in demand sectors

- To stress-test results, study consider 5 sensitivities:

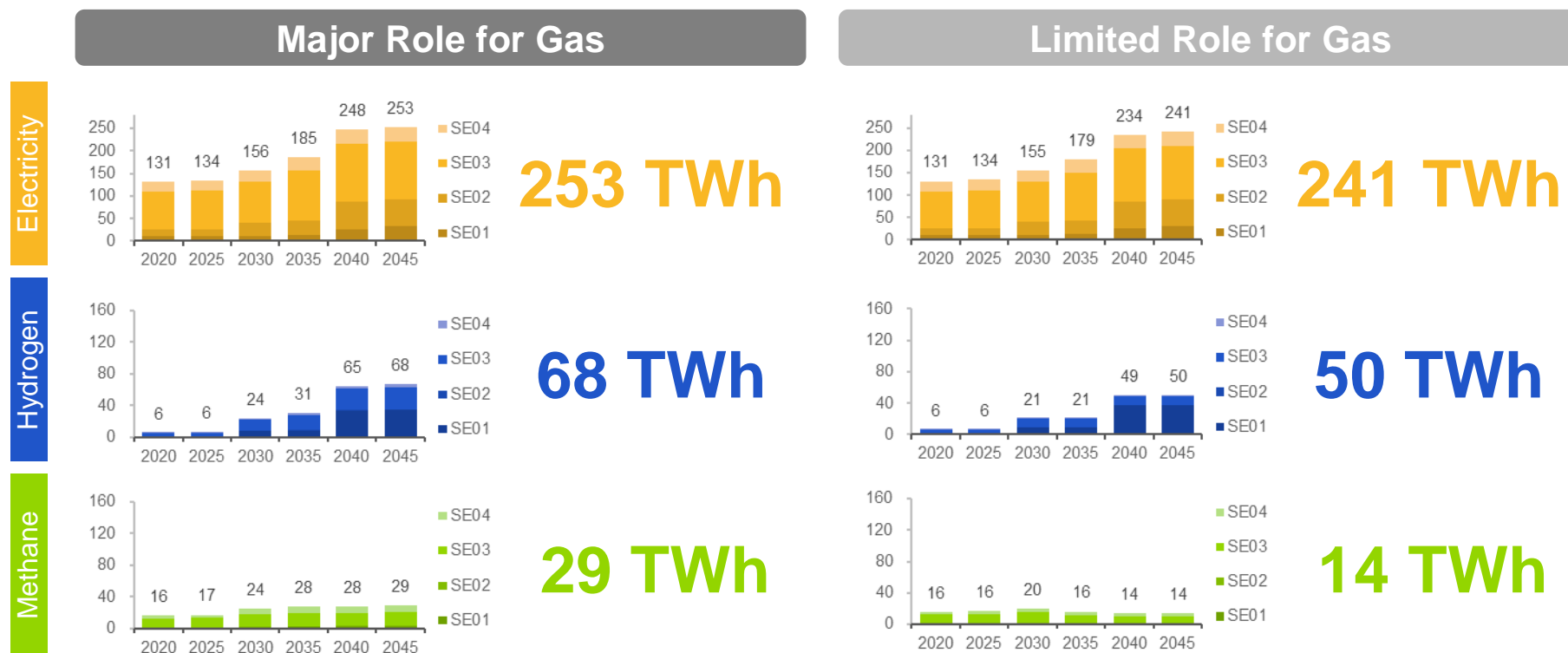
1. Low H <sub>2</sub> import costs	Impact of low H2 import costs
2. Low H2 Infrastructure costs	Impact of low H2 infrastructure costs
3. Low Electrolyser Costs	Impact of low electrolyser costs
4. Extended Nuclear Lifetime	Impact of extending the nuclear lifetime to over 60yrs
5. High Electricity & H2 Demand	Impact of a higher electricity & hydrogen demand forecast



## Demand Scenarios

# Scenarios of energy demand forecast a significant increase in electricity and gas demand from today to 2045

- Electricity demand **nearly doubles** in both scenarios, largely due to hydrogen demand.
- Hydrogen demand **increases significantly** in both scenarios.
- Methane demand **increases in one** scenario but remains **consistent in the second one**.



## Demand Scenarios

# Regional clusters of gas demand will develop and shape the development of gas infrastructure across Sweden

- **Hydrogen** demand clusters develop in **SE1** and **SE3**.
- **Methane** demand growth is largely limited to **SE3** and **SE4**.

## Major Role for Gas





# Analysis Results: Supply Capacity Buildout

Supply capacity at the national  
and regional level

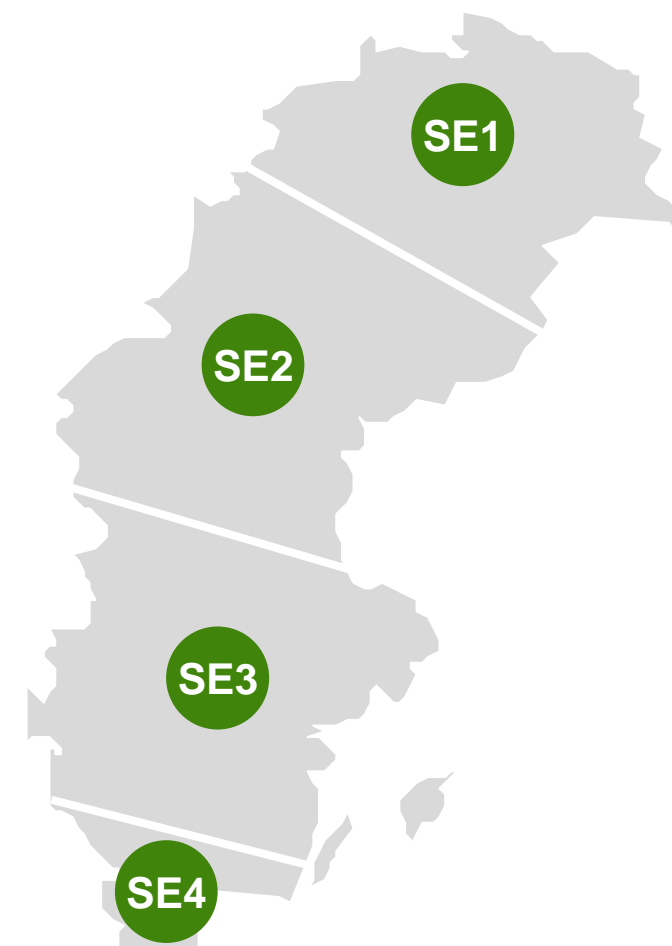
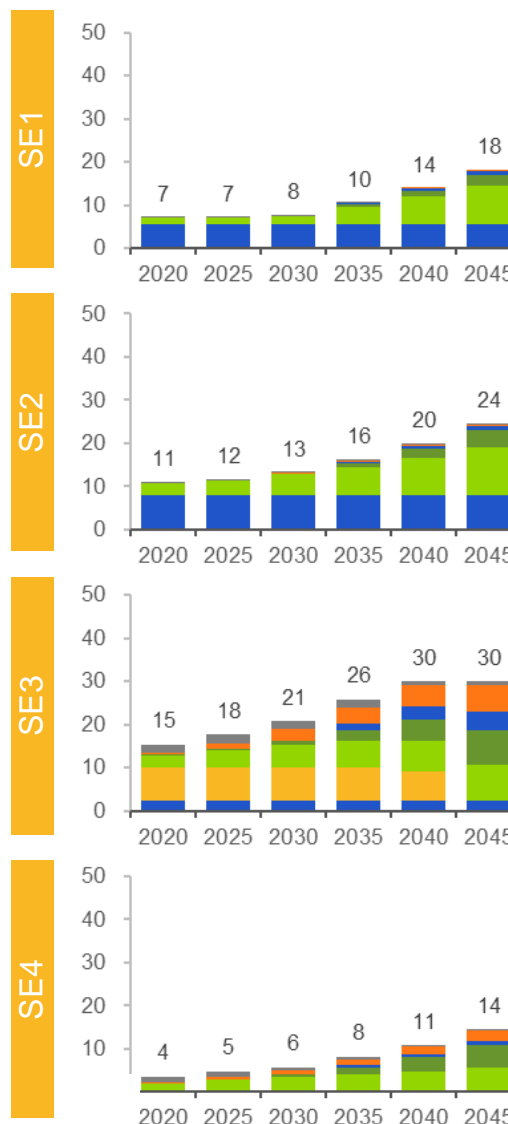
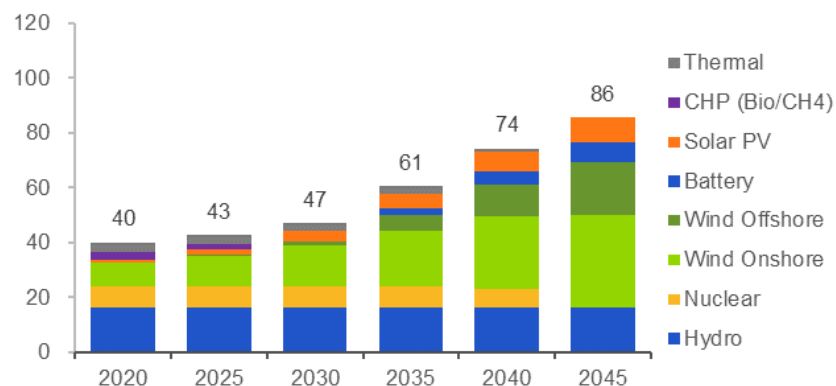
**Major Role for Gas**



# Electricity supply capacity will more than double to serve growing demand

## Sweden

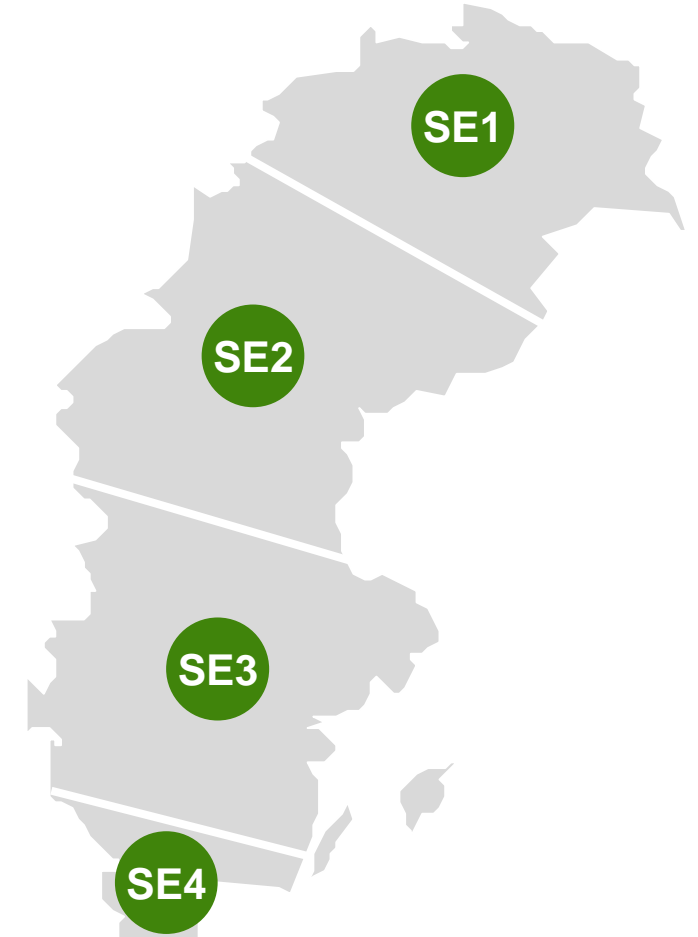
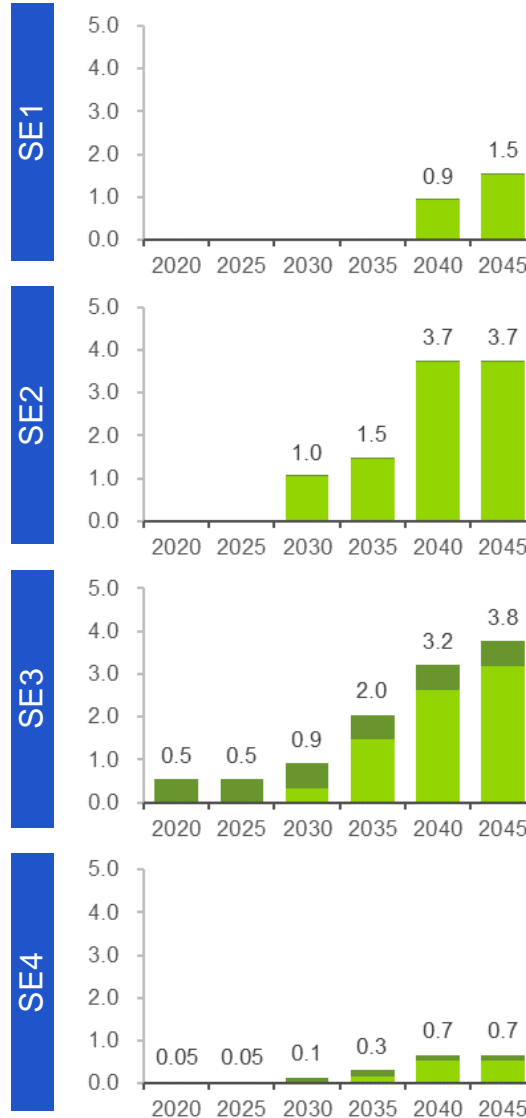
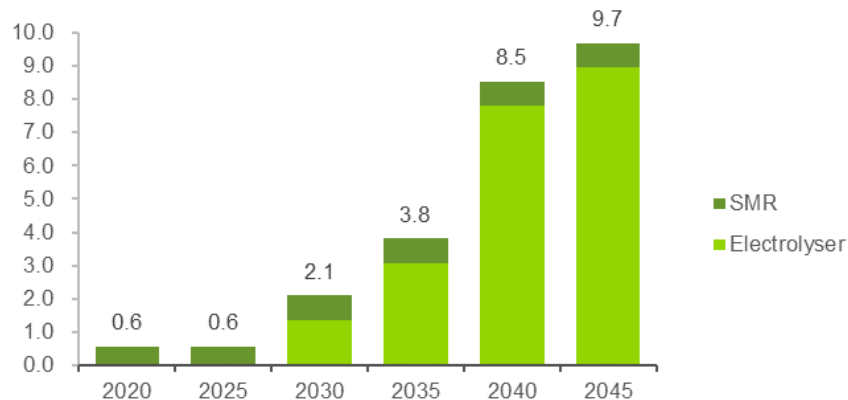
- **Generation capacity increase 2X** from 40 GW today to 86 GW by 2045
- Major **buildout of onshore and offshore** wind across all Swedish regions – leading to the expansion of electricity transmission interconnections
- **No major role for hydrogen** in energy supply or flexibility



# Electrolyser capacity will scale rapidly from 2030 as hydrogen demand grows

Sweden

- **Electrolyser capacity scales rapidly from 2030 to 2045** increasing to 9.0 GW<sub>H2</sub> (equivalent to 12.6 GW<sub>Elec</sub>)
- **A significant share of electrolyser capacity is installed in SE2** to utilise an oversupply of electricity generation
- Hydrogen production via **SMR** will continue to play a role

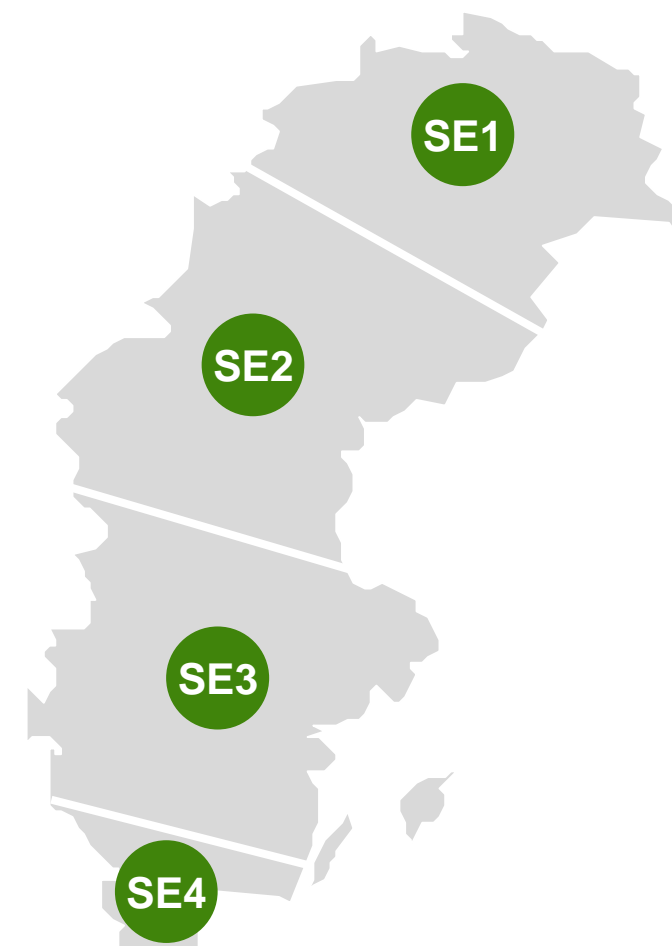
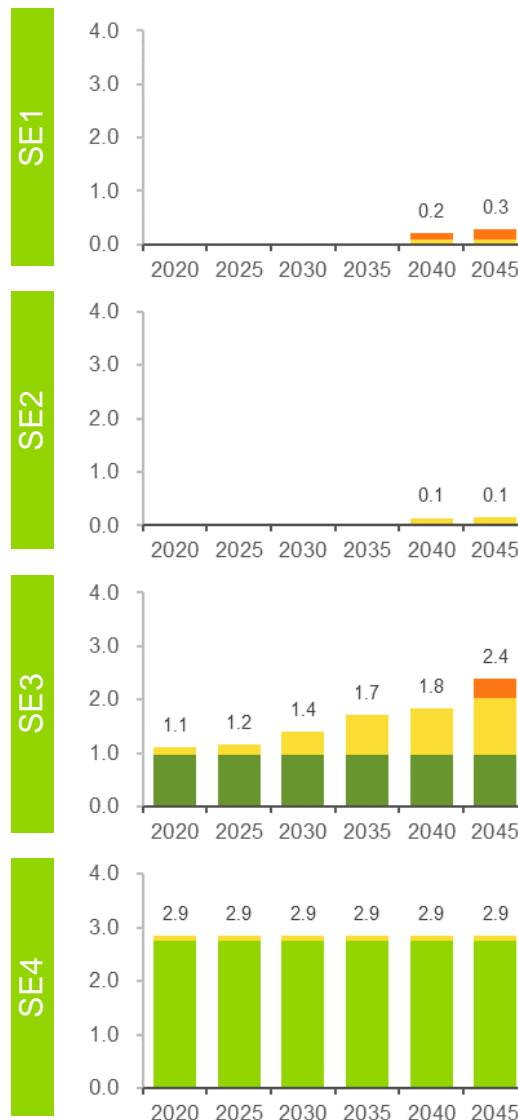
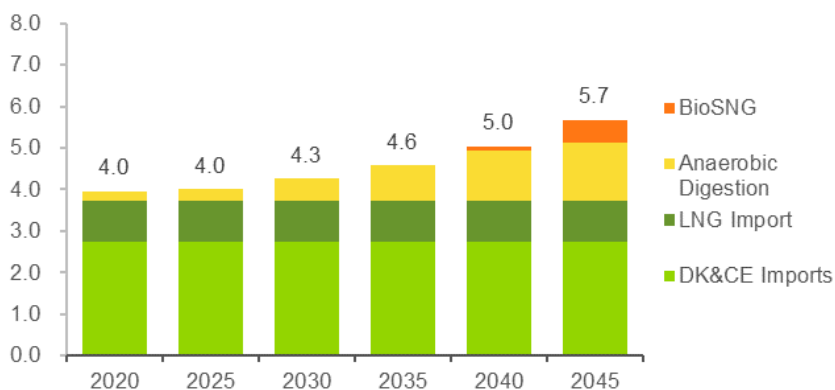




# Domestic methane supply will scale steadily from 2025/2030 to 2045

Sweden

- Expansion of **existing interconnection with DK** will not be needed beyond current levels
- **Domestic methane production will scale up** displacing some share of the methane imports from DK
- **Anaerobic digestion and biomass gasification** will scale in SE3



# Analysis Results: Infrastructure Buildout

Interconnections within  
Swedish regions and with  
neighboring regions

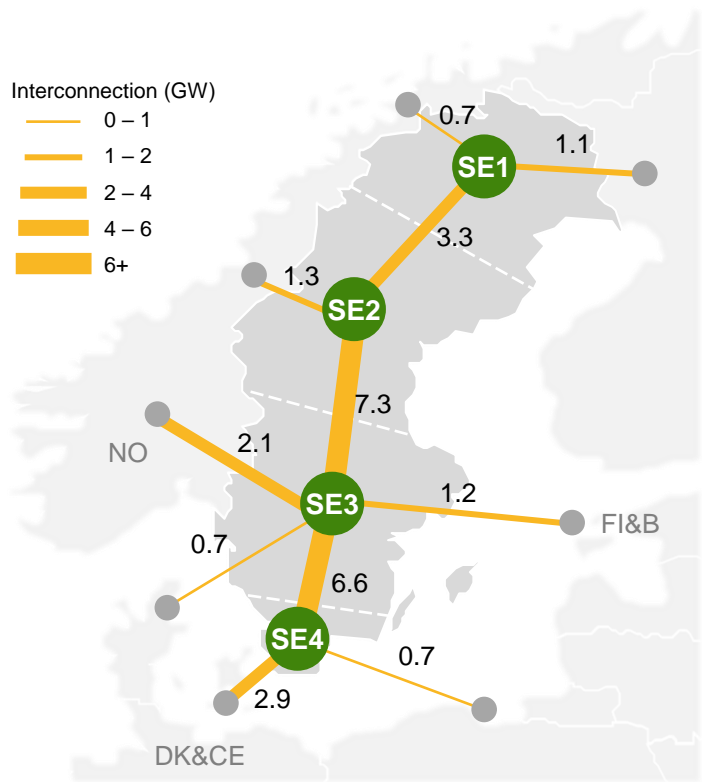
**Major Role for Gas**



# Today, gas infrastructure is limited to the south of Sweden

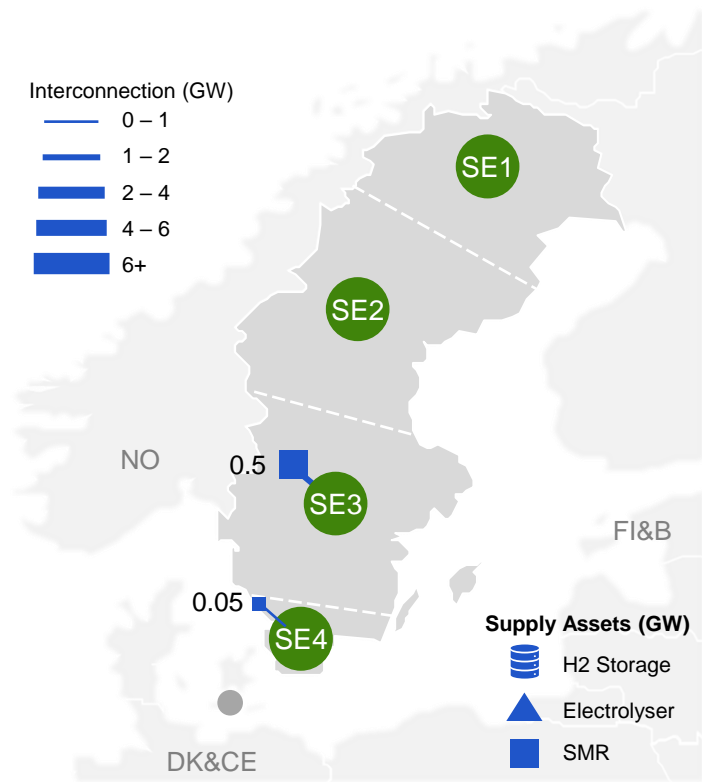
## Electricity

Highly interconnected Nordic market enabled through existing transmission infrastructure.



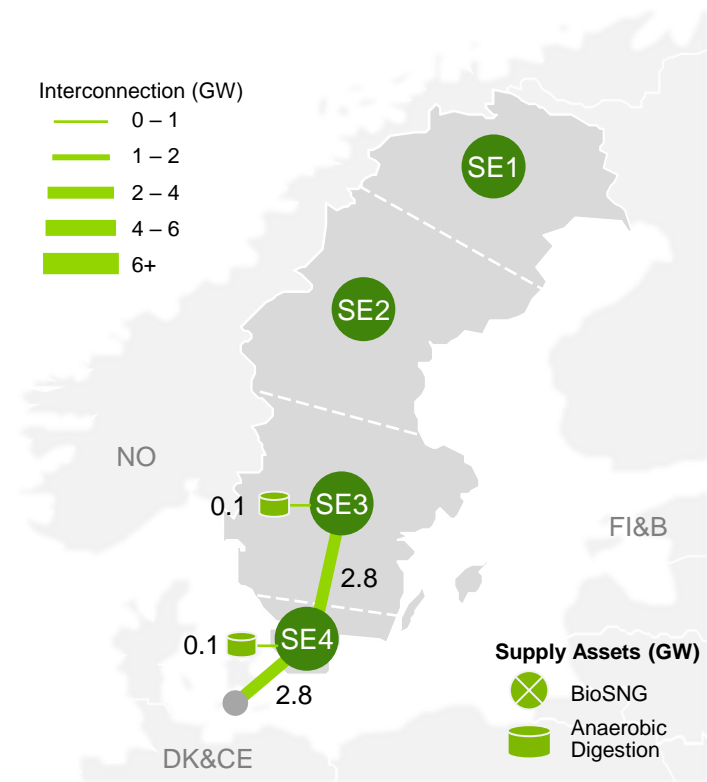
## Hydrogen

No regional H<sub>2</sub> infrastructure exists. SMR serves existing demand in SE3/4.



## Methane

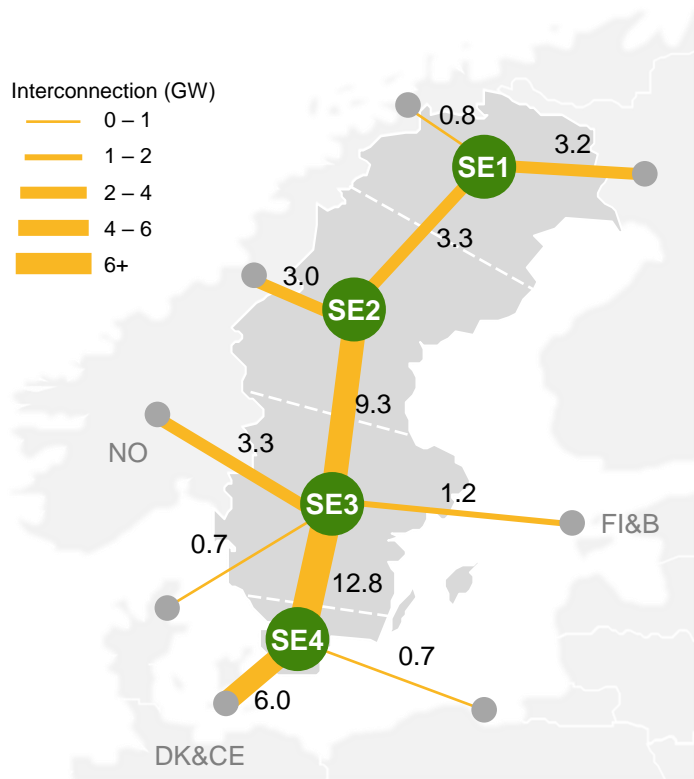
Existing gas infrastructure from DK to SE3 supplies most methane demand.



# By 2045, gas infrastructure will expand across most of Sweden

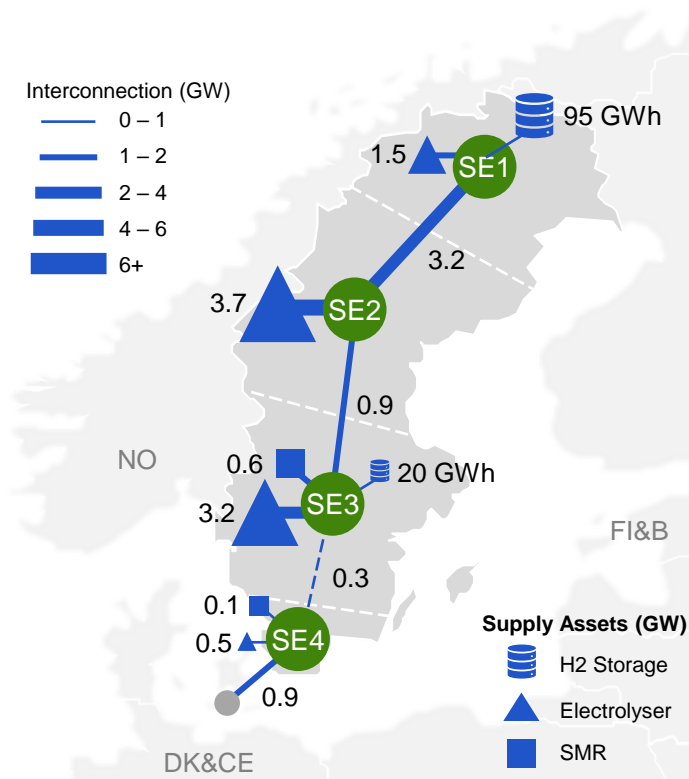
## Electricity

**Strong buildout of interconnection capacity** to accommodate increased power flows and generation capacity



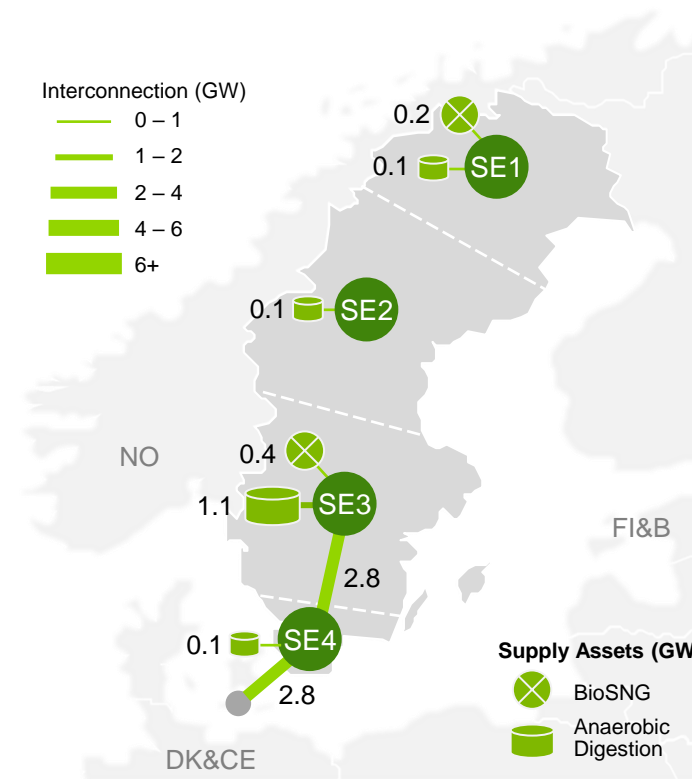
## Hydrogen

**A regional H<sub>2</sub> backbone develops** between SE1 and SE3, as well as an interconnection between SE4 and DK



## Methane

**Domestic methane supply scales up** displacing some methane imports. No expansion of methane infrastructure.



# Stress-Testing Results

Alternative Demand  
Scenarios & Sensitivities



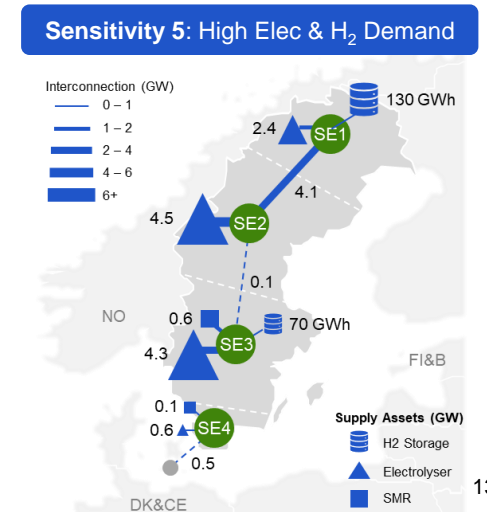
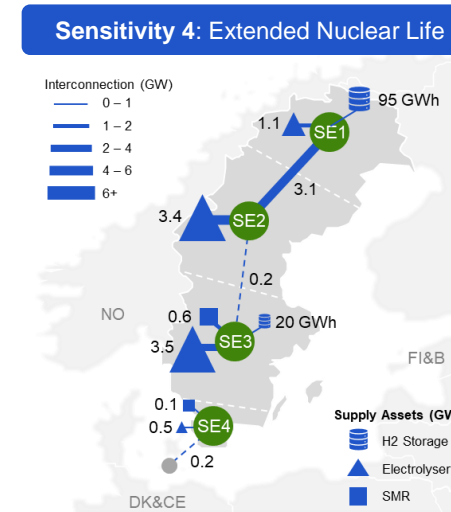
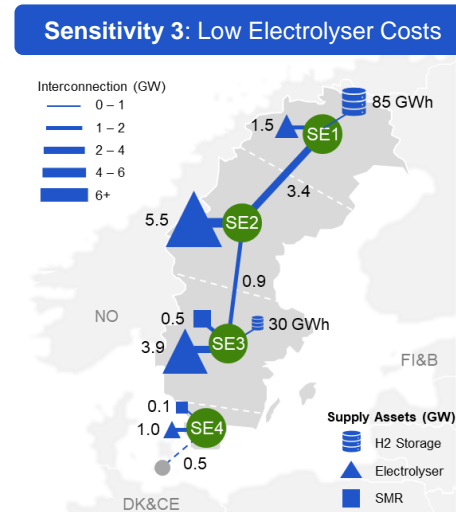
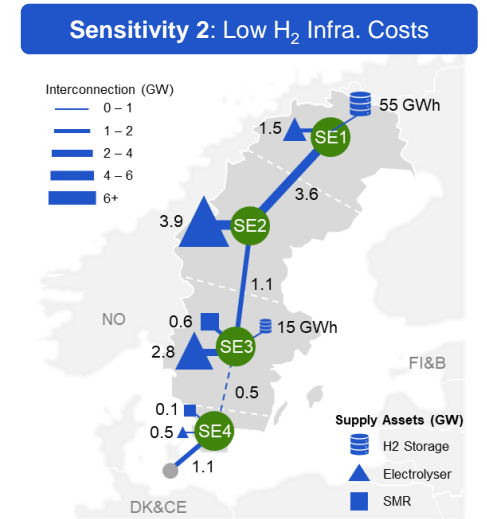
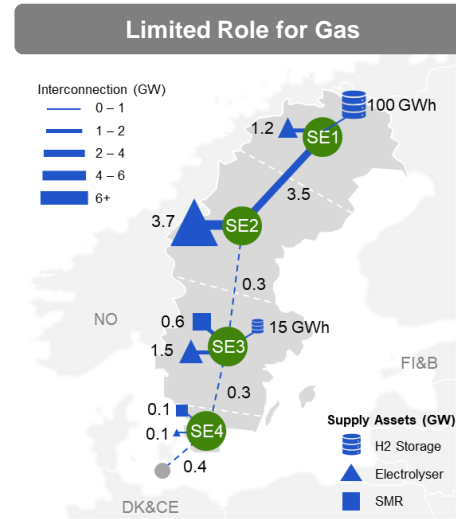


## Analysis Results

# Across all scenarios and sensitivities, the development of hydrogen infrastructure remains a constant

### Key Messages:

1. **A regional hydrogen backbone emerges** in the north of the country
2. **Electrolyser capacity scales** rapidly from 2030 to 2045, with significant capacity installed in SE2
3. **Hydrogen production via SMR** continues to play a role in the future
4. **Hydrogen storage** is critical to optimise the balancing of hydrogen supply and demand
5. **Hydrogen infrastructure plays a complementary role** to the electricity grid

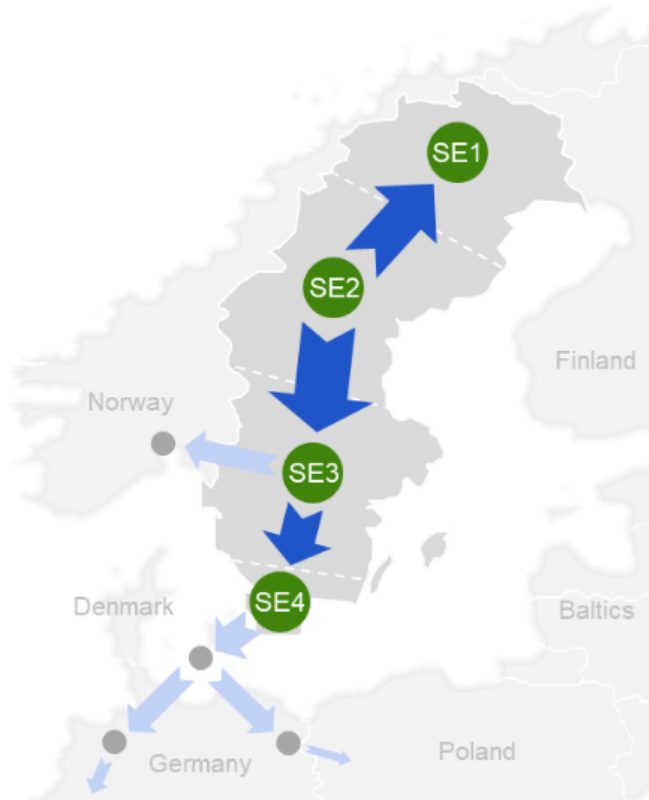


# Sweden has the potential to act as a hydrogen exporter to neighboring regions

### Key Messages:

1. **Swedish hydrogen supply** meets nearly all hydrogen demand, with only a very small need for imports
2. **Low-cost electricity production** in northern Sweden is key in maintaining hydrogen supply cost-competitive
3. **Electrolyser capacity could scale further** in order to increase hydrogen production for exports to Denmark & Mainland Europe (via SE4) or Finland (via SE1)

### Sweden as a H<sub>2</sub> Exporter



### H<sub>2</sub> Interconnection with Finland



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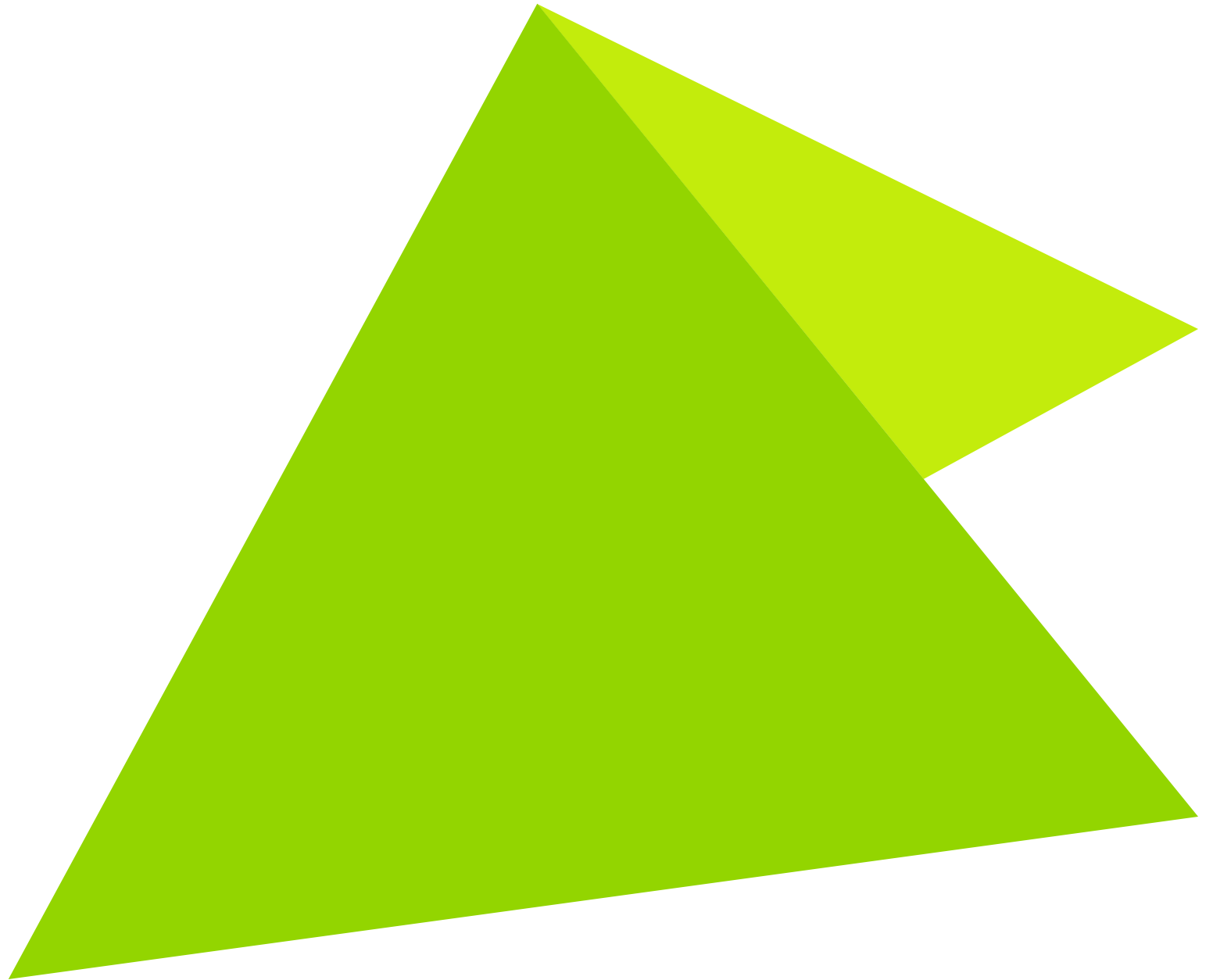
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## To scale up gas supply and infrastructure, action is required by all Swedish energy stakeholders

