Kyoto University

Can the EU achieve near 100% renewables?

What are the obstacles and roles of policy interventions?

Unnada Chewpreecha

Date: 17 February 2020

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clarity from complexity

Overview

- Current renewable trends in the EU
- EU Renewable targets
- High renewable shares – how?
- High renewable shares – Sweden case study
- High renewable shares – challenges ahead
- What are the policy implications?

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Current renewable trends in the EU

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Renewable energy in Europe

- European Union (EU) has been at the forefront of global renewable energy deployment. The adoption of long-term targets and supporting policy measures has resulted in strong growth in renewable energy deployment across the region, from a 9% share in gross final energy consumption in 2005 to 16.7% in 2015. (IRENA, 2015)
- Some areas of Europe have a greater potential for renewables than others. For instance, some countries may have more rivers suitable for hydroelectric power, while others may have more yearly sunshine better suitable for solar.

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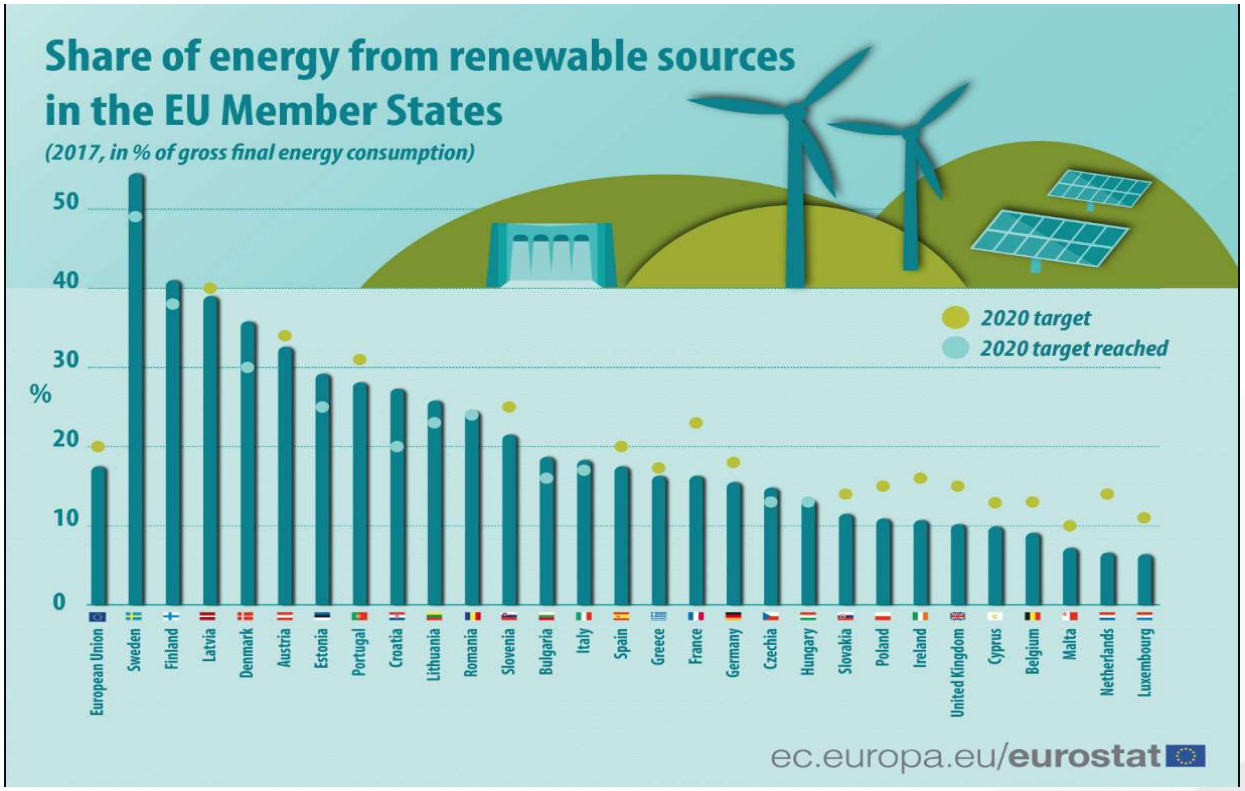
Share of energy from renewable sources- total

- 2017 situation and 2020 target



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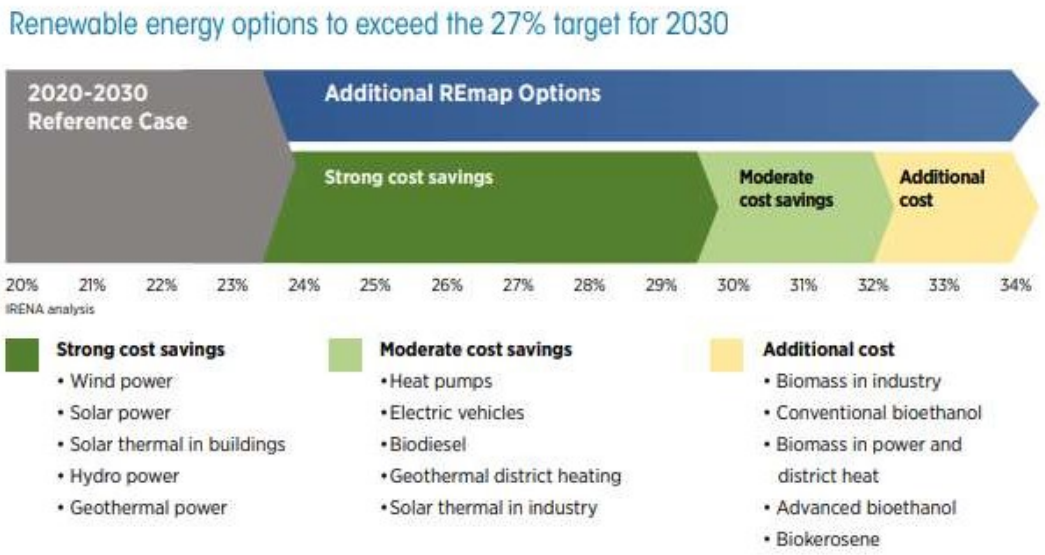
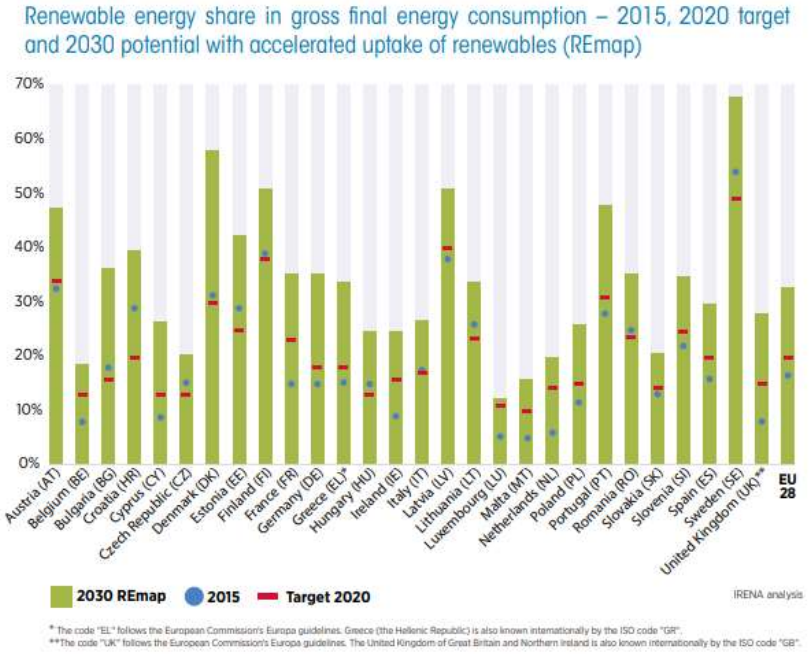
EU Renewable Potentials

- Cost effective options (REMAP, 2018 - IRENA)





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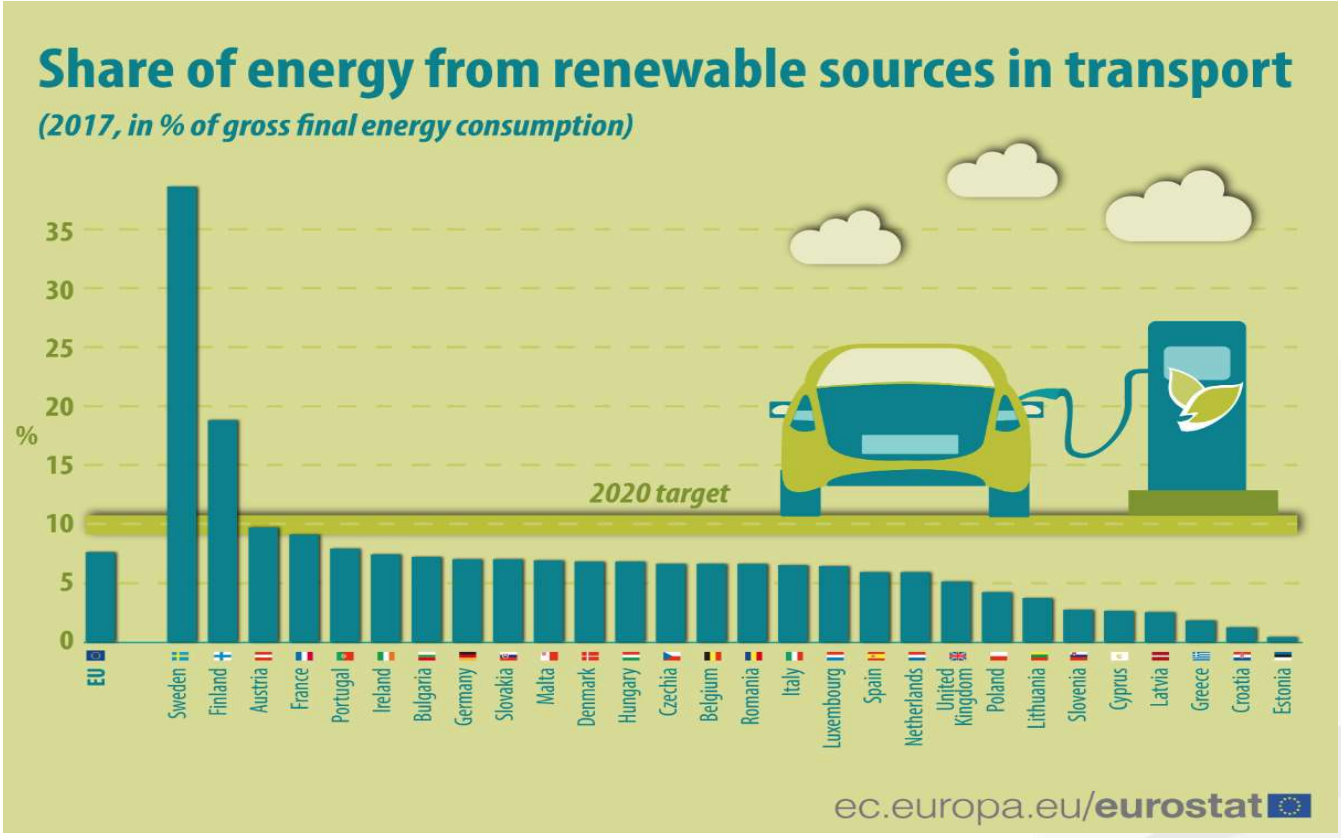
Share of energy from renewable sources - transport

- Bullets about the chart



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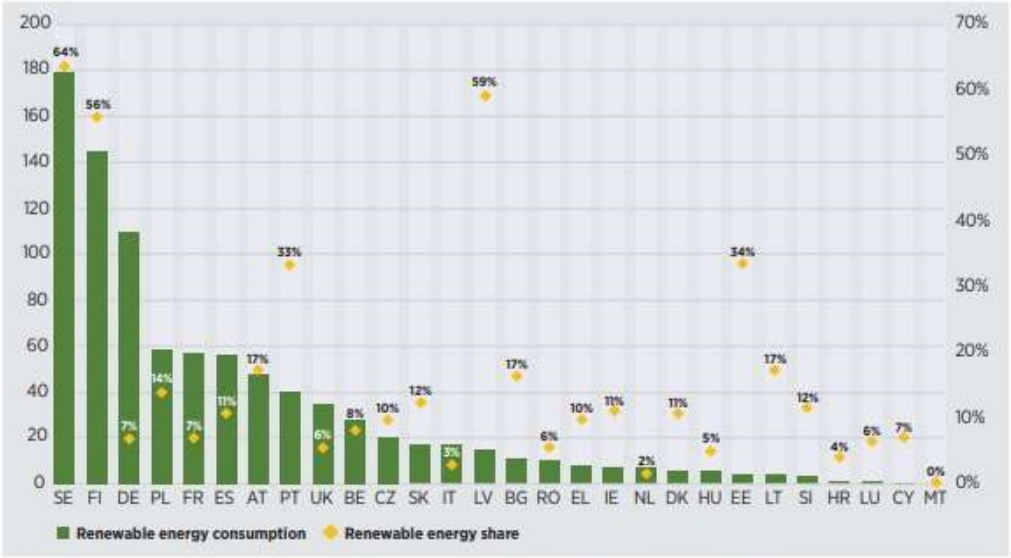
Share of energy from renewable sources - industry

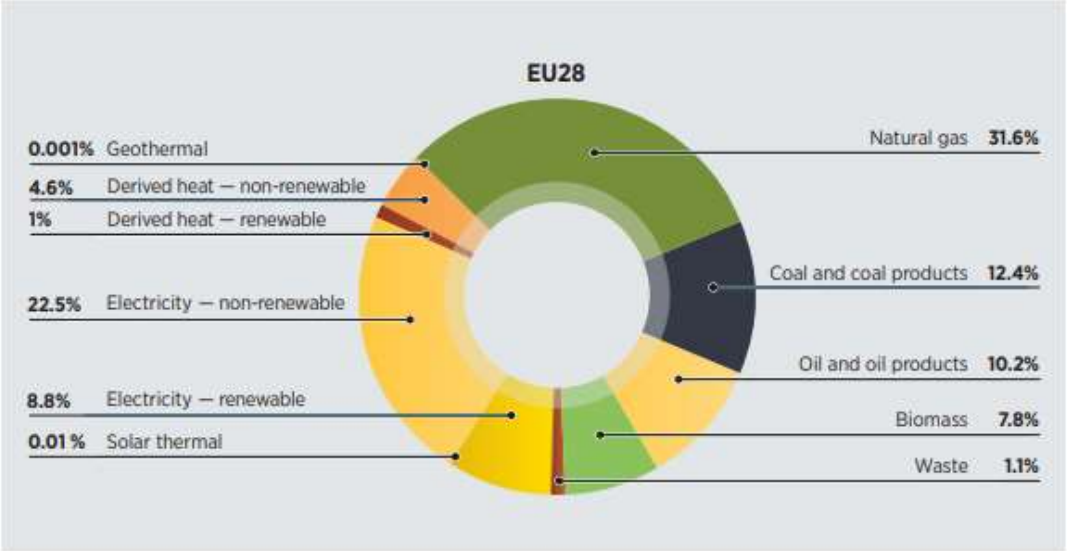
- Bullets about the chart

Figure 30: Total renewable energy consumption (PJ) and renewable share in the industrial sector by EU Member State, 2015



Source: IRENA analysis based on Eurostat (2017b). Note: Excludes renewable power and district heating.

Figure 29: Breakdown of industrial energy use in the EU-28 by energy carrier (excluding non-energy use), 2015



Source: Eurostat (2017b)

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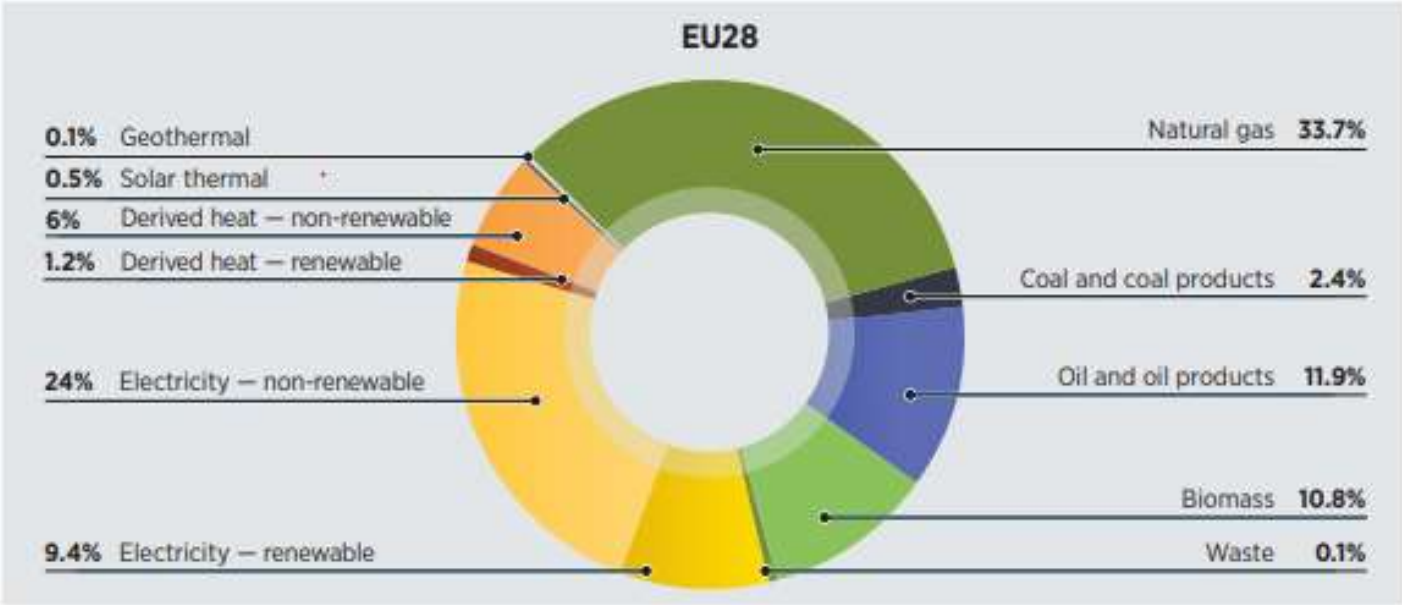
Share of energy from renewable sources - buildings

- Bullets about the chart

Figure 33: Breakdown of final energy use in the EU-28 buildings sector, 2015



Source: Eurostat (2017b)

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EU Renewable Targets

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EU Renewable targets and long term climate goal

- 2020 (binding legislation)
  - 20% cut in greenhouse gas emissions (from 1990 levels)
  - **20% of EU energy from renewables**
  - 20% improvement in energy efficiency
- 2030
  - At least 40% cuts in greenhouse gas emissions (from 1990 levels)
  - **At least 32% share for renewable energy**
  - At least 32.5% improvement in energy efficiency
- 2050
  - a climate-neutral future in line with the Paris Agreement objective of well below 2°C and pursue efforts to keep it to 1.5°C.

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EU Renewable Energy Directive

The creation of Europe's internal energy market creates great opportunities for countries to work together to exploit these renewable resources and meet their 2020 renewable energy targets. They can do this through the cooperation mechanisms set up under the **Renewable Energy Directive**:

- statistical transfers
- joint projects
- joint support schemes

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Statistical transfers

In a statistical transfer, an amount of renewable energy is deducted from one country's progress towards its target and added to another's. This is an accounting procedure and no actual energy changes hands.

By allowing transfers of this kind, this cooperation mechanism provides EU countries with an added incentive to exceed their targets because they can receive a payment for energy transferred to others. It also allows countries with less cost-effective renewable energy sources to achieve their targets at a lower cost.

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Joint projects

Two or more EU countries can co-fund a renewable energy project in electricity or heating and cooling, and share the resulting renewable energy for the purpose of meeting their targets. These projects can but do not have to involve the physical transfer of energy from one country to another.

EU countries may also enter into joint projects with non-EU countries. The resultant energy will count towards national targets if the project involves:

- electricity generation
- the physical flows of energy into the EU (to ensure that the project has a real effect on the amount of renewable energy consumed in the EU)

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Joint support scheme

Two or more EU countries can co-fund a joint support scheme to spur renewable energy production in one or both of their territories. This form of cooperation can involve measures such as a common feed-in tariff, a common feed-in premium, or a common quota and certificate trading regime.

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High renewable shares – How?

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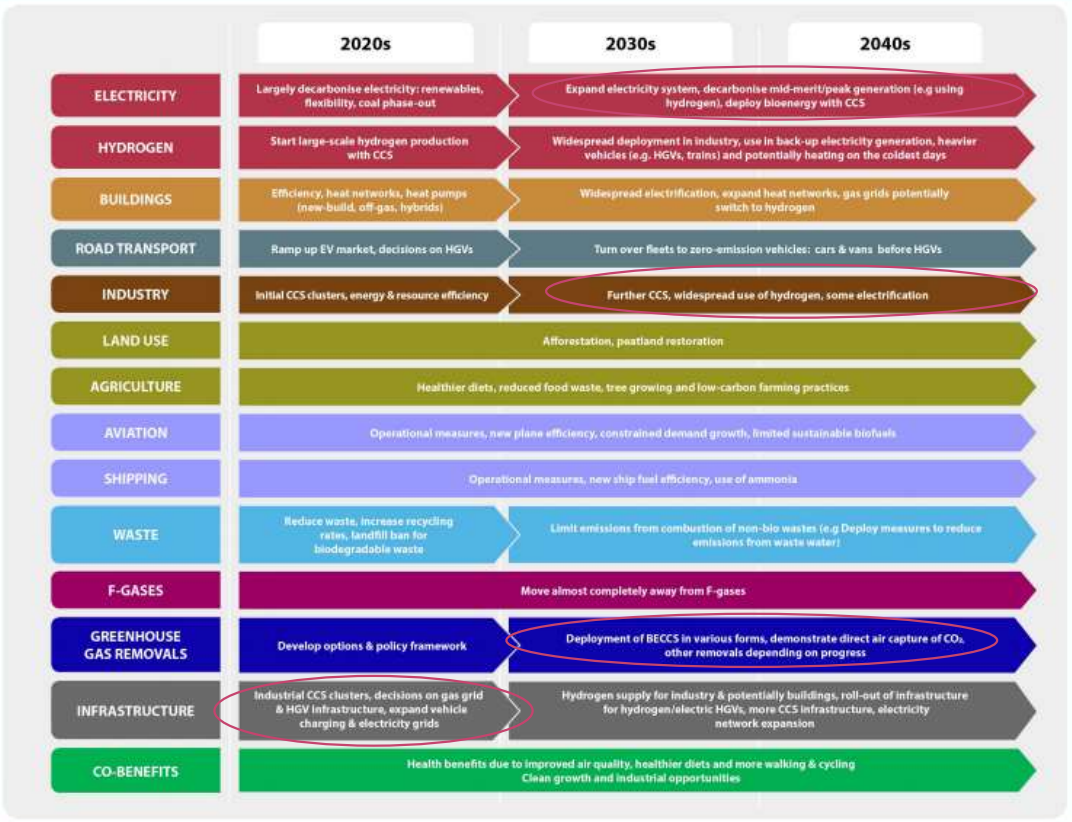
UK Net zero GHG example

Figure 2. UK net-zero GHG scenario



Source: CCC analysis.
Notes: CCS = carbon capture and storage. EV = electric vehicle. BECCS = bioenergy with CCS.

- Some fossil fuels remain
- Use CCS
- Use bioenergy with CCS for negative emissions

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100% renewables?

Power

- Wind, Solar, Hydro
- Nuclear?
- Grid flexibility, storage and connectivity

Road transport

- Electric vehicles
- Biofuels
- Shift in mode of transport
- Behaviour change

Households

- Electrification
- Electric cooking
- Energy efficient appliances
- Behaviour change

Buildings

- Electrification
- Energy efficient buildings
- Renewable sources (e.g. geothermal)

Industries (easy)

- Engineering, Textiles, Food, Paper and Pulp
- Electrification
- Energy efficiency
- Switch to renewable sources (biofuels)

Industries (medium)

- Electrification
- Hydrogen
- Biofuel
- New technology needed

Industries (hard)

- Electrification
- Hydrogen
- Biofuel
- New technology needed

Freights

- Hydrogen
- Biofuels
- Behaviour change e.g. by local products

Air transport

- Biofuels?
- Hydrogen?
- New technology needed
- Limited travel

Water transport

- Methanol produced from renewable?
- Electric
- Demand management and green logistic

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High renewable shares – Sweden Case Study

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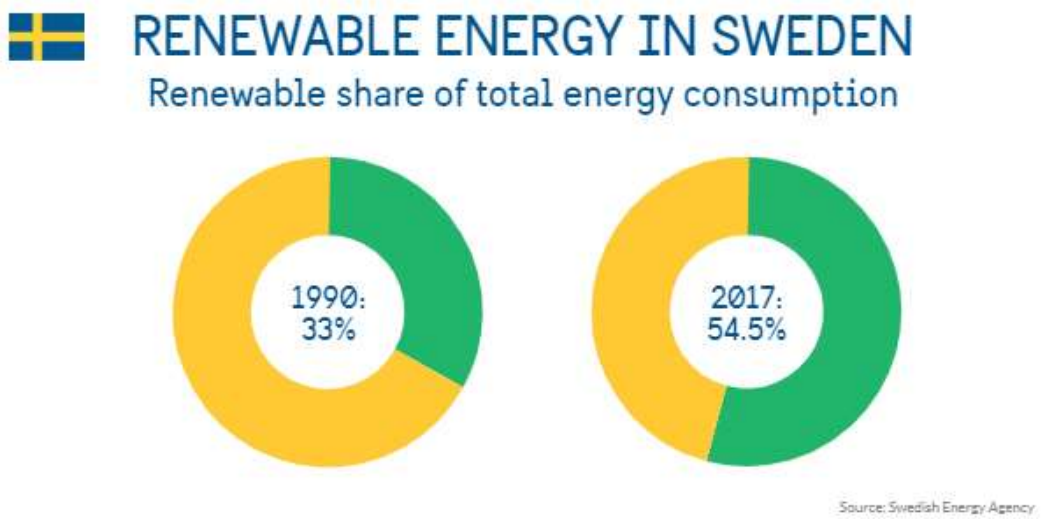
Sweden Case Study



Sweden target:

- 100% renewables electricity generation in 2040
- zero-carbon economy by 2045

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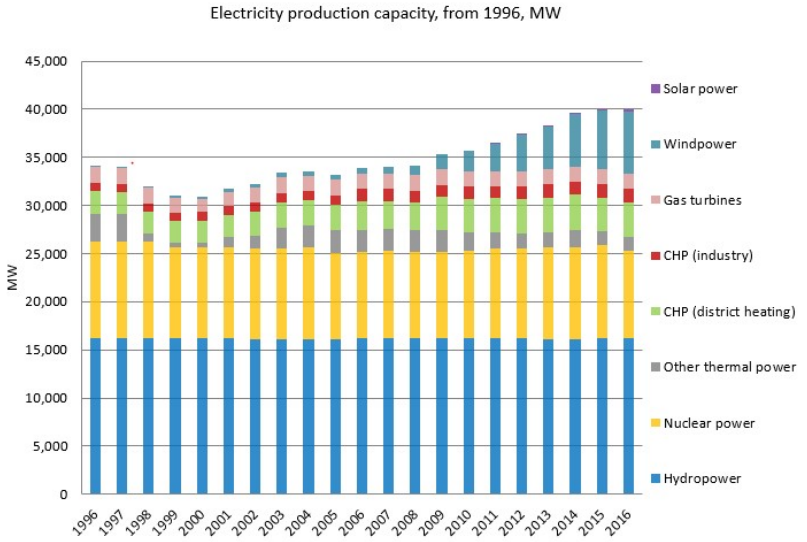
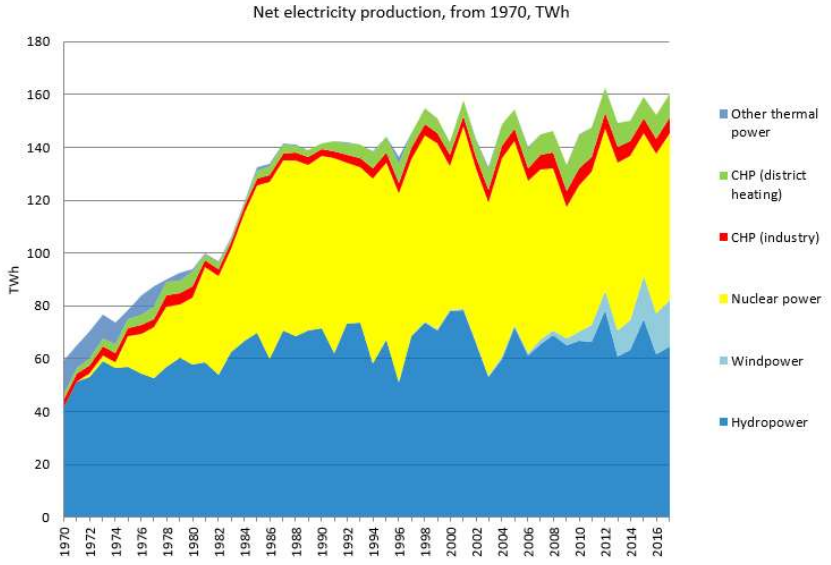
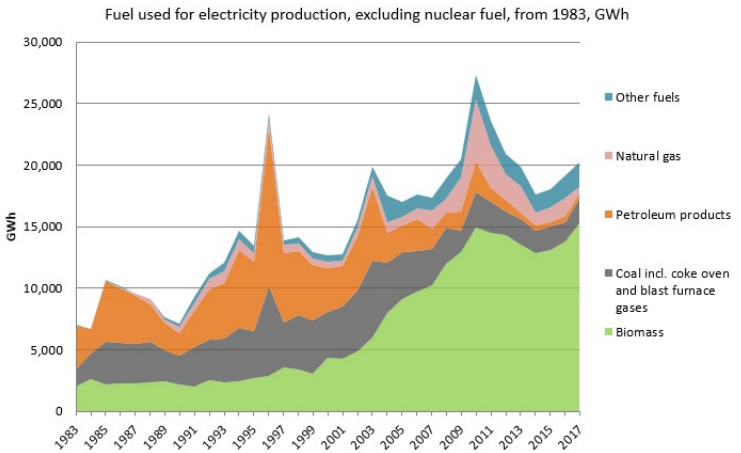
Sweden Case Study



Source(s): Swedish Energy Agency





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Sweden challenges

- Can it still be fossil fuel free if Sweden phase-out of nuclear within the next few decades?
- In addition, can Sweden increase its hydropower capacity? At what economic and environmental expense?
- Can Sweden rely on increasing the share of biomass in its energy mixture?
- If intermittent renewable capacity is increased, how will Sweden deal with storage?
- Is there enough power capacity to cope with electrification in other sectors e.g. electric vehicles?

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High renewable shares – Challenges

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Operational challenges

Problems with having high intermittence renewable share in the power mix:

- Unable to meet basic peak demand
- Security of energy supply
- Capacity requirement is far greater
- Intermittency of renewables can also lead to price uncertainty
- Back up generation – coal, gas, oil, nuclear all have negative implication
- Grid infrastructure requires large investments
- Storage (e.g. H_2, CAES, etc.) – implications on price and investment needs
- Demand responses – Can they be relied on?

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Other real world challenges

Low carbon technologies exist already but transition has important real-world challenges:

- Political – energy security, fossil fuels subsidies, lack of carbon pricing or incentives, corruptions
- Economic – competitiveness, sustainable consumption leading to reduction in output
- Societal – reluctant to change, job losses in energy sectors
- Distribution – high energy price affecting low income households
- Financial- access to finance, stranded fossil fuel assets, stranded machinery etc
- Livelihood – loss of land, less space for food crops
- Lack of information – inability to work out what is the best option
- Lack of renewable potentials – land or natural resource constraints
- Lack of infrastructure – EVs charging points, battery storage, grids connections

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Harder-to-Abate Sectors

- Some sectors are hard to switch to renewables, there are currently no viable technologies to move them away from using fossil fuels
  - Steel → hydrogen
  - Cement → CCS
  - Aviation → biofuel, synfuel, hydrogen ???

Image: Energy Transitions Commision

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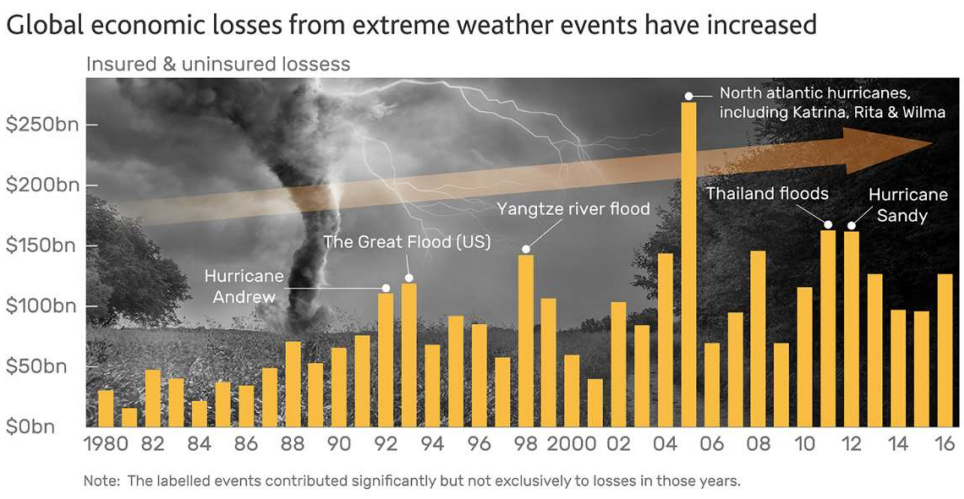
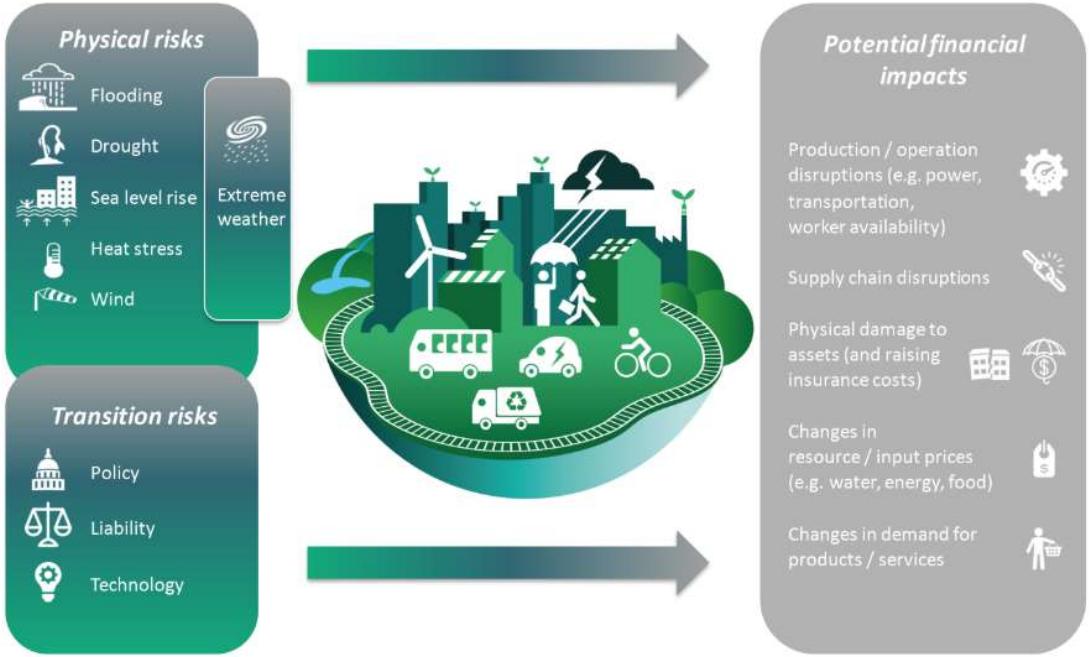
But risks from inaction are far greater

- Climate risks: temperature change, wildfire, flooding, rising sea level, unpredictable weather, damage to crops, wildlife and ecosystem
- Pollutions affecting human health and cause of early deaths
- Labour productivity
- Financial implication: insurance claims, medical bills, crop yields, lower GDP
- Missed opportunity: investment in renewable, energy efficiency, new green industries
- Learning curve: new technologies become cheaper over time (S curve)

Next financial crisis? – not meeting 2c target



Source(s) Bank of England



Source(s) Centre for International Climate Research

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Next financial crisis? – transition risks & stranded assets

Figure 4 : Selected examples of impact of asset stranding on liability and assets

Assets	Liabilities
U1 – **Upstream energy assets:** Oil and coal reserves become stranded due to international top-down carbon budget constraints i.e. "unburnable carbon"	U2 – **Upstream energy liabilities**: Third-party liability claims against companies (and their D&Os) responsible for climate change
D1 – **Downstream energy assets:** Premature closure of coal power stations due to concerns about climate change and the fossil-fuel divestment campaign	D2 – **Downstream energy liabilities**: Increased political risk events due to government energy policies induced by climate change concerns
D3 – **Downstream energy assets:** Residential solar PV and electricity storage (in part connected to electric vehicles) impairs the market for centralised electric generation	
R1 - **Residential property assets:** mandatory energy efficiency improvements reduce the value of the least efficient housing stock and increase the value of the most efficient housing stock	C1 - **Commercial property liabilities**: property industry professionals and governments are sued for negligence for not disclosing, reporting or for being misleading on the climate change impacts for property investors
S1 - **Shipping assets**: pressure to reduce carbon emissions increases the value of newer, larger, more efficient ships and reduces the value of older, smaller, less efficient ships	

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Next financial crisis? – transition risks & stranded assets

> *Our analysis suggests that, contrary to investor expectations, the stranding of fossil fuels assets may happen even without new climate policies. This suggests a carbon bubble is forming and it is likely to burst.*
>
> *Individual nations cannot avoid the situation by ignoring the Paris Agreement or burying their heads in coal and tar sands.*
>
> *For too long, global climate policy has been seen as a prisoner's dilemma game, where some nations can do nothing and get a 'free ride' on the efforts of others. Our results show this is no longer the case.*

Clear economic winners and losers

Publishing their findings today the researchers from Cambridge University (UK), Radboud University (NL), the Open University (UK), Macau University and Cambridge Econometrics, argue that there will be clear economic winners and losers as a consequence.

Japan, China and many EU nations currently rely on high-cost fossil fuel imports to meet energy needs. They could see national expenditure fall and – with the right investment in low-carbon technologies – a boost to Gross Domestic Product (GDP) as well as increased employment in sustainable industries.

However, major carbon exporters with relatively high production costs, such as **Canada, the United States and Russia**, would see domestic fossil fuel industries collapse. Researchers warn that losses will only be exacerbated if incumbent governments continue to neglect renewable energy in favour of carbon-intensive economies.

High renewable shares – Policy Implications

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Policy implications – addressing operational challenges

1. Back-up dispatchable power,
2. Demand response and energy efficiency measures
3. Distributed generation
4. Data-driven smart technologies
5. Grid-level energy storage
6. More integrated networks
7. Large scale back-up storage
8. Tariff free renewable energy trade

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Policy implications - general

1. To promote take up of renewables
   - ✓ renewable subsidies
   - ✓ feed-in-tariffs
   - ✓ public awareness information
2. To discourage the use of fossil fuels
   - ✓ carbon pricing
   - ✓ regulation
   - ✓ removal of fossil fuel subsidies
3. Improve access to finance
   - ✓ green loans/ credits
   - ✓ Funding for R&D
4. Manage transition risks
   - ✓ manage investment portfolio

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Policy implications - general

5. Managing energy demand
   - ✓ promote energy efficiency
   - ✓ sustainable and circular economy
6. To make the transition fairer and economically viable
   - ✓ environmental tax reform
   - ✓ compensation for those adversely affected by the transition (between regions, sectors, households and workers)
   - ✓ Retain workforce suitable for transition
7. Land management
   - ✓ Make sure balance allocation between land use for food and for fuel crops
   - ✓ avoid deforestation
8. New technologies
   - ✓ R&D support for new technologies especially in the hard to abate areas

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