Sustainability, Vattenfall & nuclear decommissioning

International workshop on Application of Sustainability Principles and Circular Economy to Nuclear Decommissioning

Rome, 18-21 June 2018

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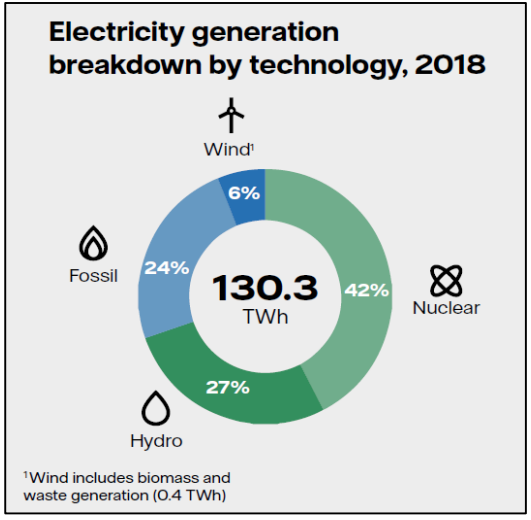
BU Nuclear Decommissioning

This presentation

1. Vattenfall at a glance
2. Our approach to sustainability
3. Vattenfall & nuclear decommissioning
4. Addressing sustainability in our nuclear decommissioning

This is Vattenfall



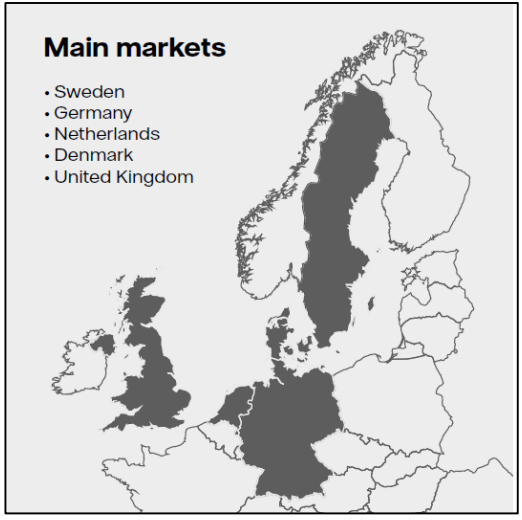
6.5 million
Electricity customers

2.1 million
Heat customers

3.3 million
Electricity network customers

2.4 million
Gas customers

19,910
Employees



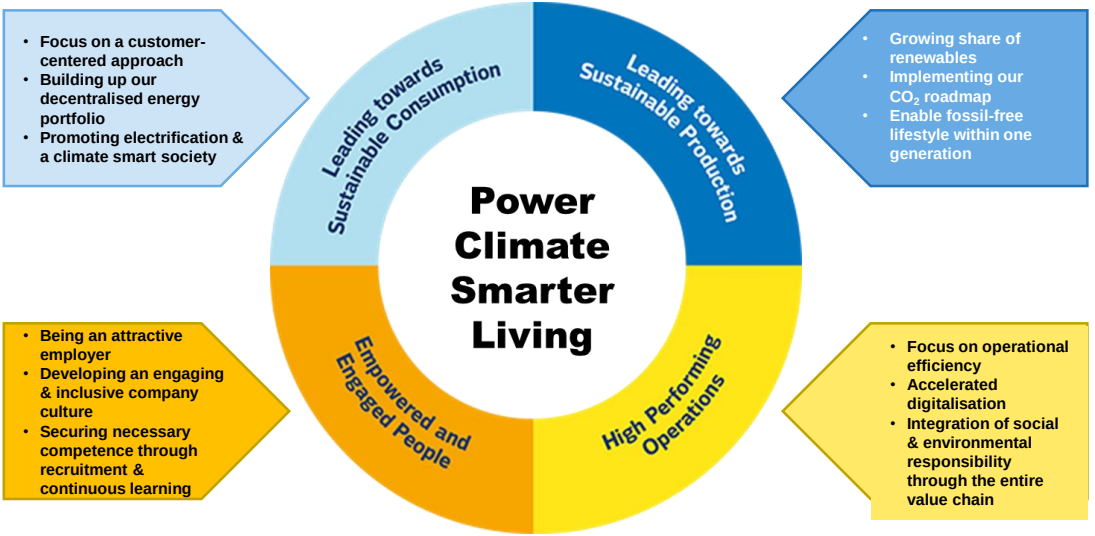
Our sustainability promise

- For Vattenfall, sustainability means **taking responsibility** for coming generations by **contributing** to sustainable development: economically, environmentally & socially
- We are **committed to meeting society's needs** by delivering energy in a reliable and sustainable manner
- We **continuously challenge** the way we work
- We will **integrate sustainability aspects in everything we do**

UN's Global Goals

Vattenfall's Annual and Sustainability Report 2018
https://group.vattenfall.com/investors/financial-reports-and-presentations

Our sustainability objectives



Leadership, innovation & collaboration

- Vattenfall's current projects with industrial partners have the potential to reduce Sweden's CO_2 emissions by a total of 30%
- Similar plans are being drawn up for Vattenfall's other core markets as well
- For Vattenfall, this is a crucial part of the strategy of offering all its customers climate-smart energy and enabling a life free of fossil fuels within one generation

Vattenfall: Tre initiativ som sänker utsläppen 30 procent

MINSKAD KLIMATPÅVERKAN: Vi inleder samarbeten med SSAB, LKAB, Preem och Cementa, skriver Vattenfalls Magnus Hall. Foto: Fredrik Sandberg

DEBATT. Vattenfall har med olika partner inom industrin startat tre initiativ som kan sänka Sveriges totala koldioxidutsläpp med 30 procent. Samtidigt finns det mycket mer vi kan göra i Sverige och i övriga Europa för att nå klimatmålen, skriver Vattenfalls koncernchef Magnus Hall.

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HYBRIT – a major collaborative initiative for sustainability

- Steel production
  - Global production expected to double by ca 2050, proportion of recycled scrap as input growing
  - Today responsible for 7% of global & 10% of Sweden's CO_2 emissions
- Aiming to replace coal & coke with sustainably produced hydrogen

LKAB

VATTENFALL

SSAB

For more information, see HYBRIT webpage: http://www.hybritdevelopment.com/

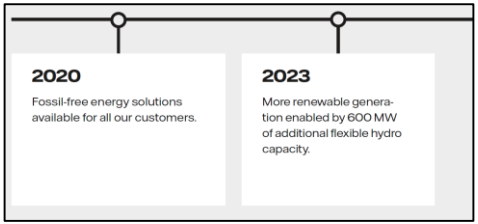
CemZero - zero emissions from cement production

- **Cementa** is already a world-leader in low emissions from cement production (ca 15% lower than average)
- **Vattenfall & Cementa** exploring an even more sustainable process
  - Electrified cement production
  - Objective of **zero** carbon dioxide emissions by 2030
- Equivalent to a reduction of about 5% of Sweden's total emissions
- Initial pilot study positive. Now in-depth investigation on how a pilot plant can be built

CEMENTA HEIDELBERGCEMENT Group VATTENFALL

Vattenfall’s Generation portfolio

- Already Vattenfall is one of the **largest providers** of fossil free electricity in Europe
- Further **transforming our production portfolio**
  - ➢ Phasing out fossil production
  - ➢ Investing in renewables
  - ➢ Innovating with new ways of energy storage



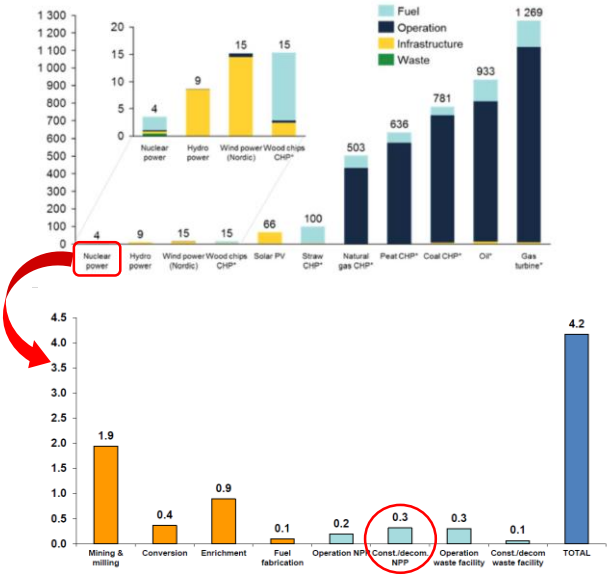
- Our **fossil-free & cost-effective nuclear power** generation have a key role in the phase-out of fossil fuels from the energy system
- As a responsible owner, Vattenfall will maintain a leading position in **nuclear safety**, and ensure **effective dismantling** of decommissioned nuclear power plants
- **Successfully delivering our decommissioning mission** underpins Vattenfall’s continued nuclear generation in Sweden

Helping meet our climate goal

- Vattenfall aims to reduce climate burden from **all** its activities, including nuclear
- Need to analyse and understand our nuclear climate footprint
  - Includes the climate footprint of our **nuclear decommissioning activities** (demolition, waste, transport)
- Identify specific opportunities for potential reductions, and their feasibility

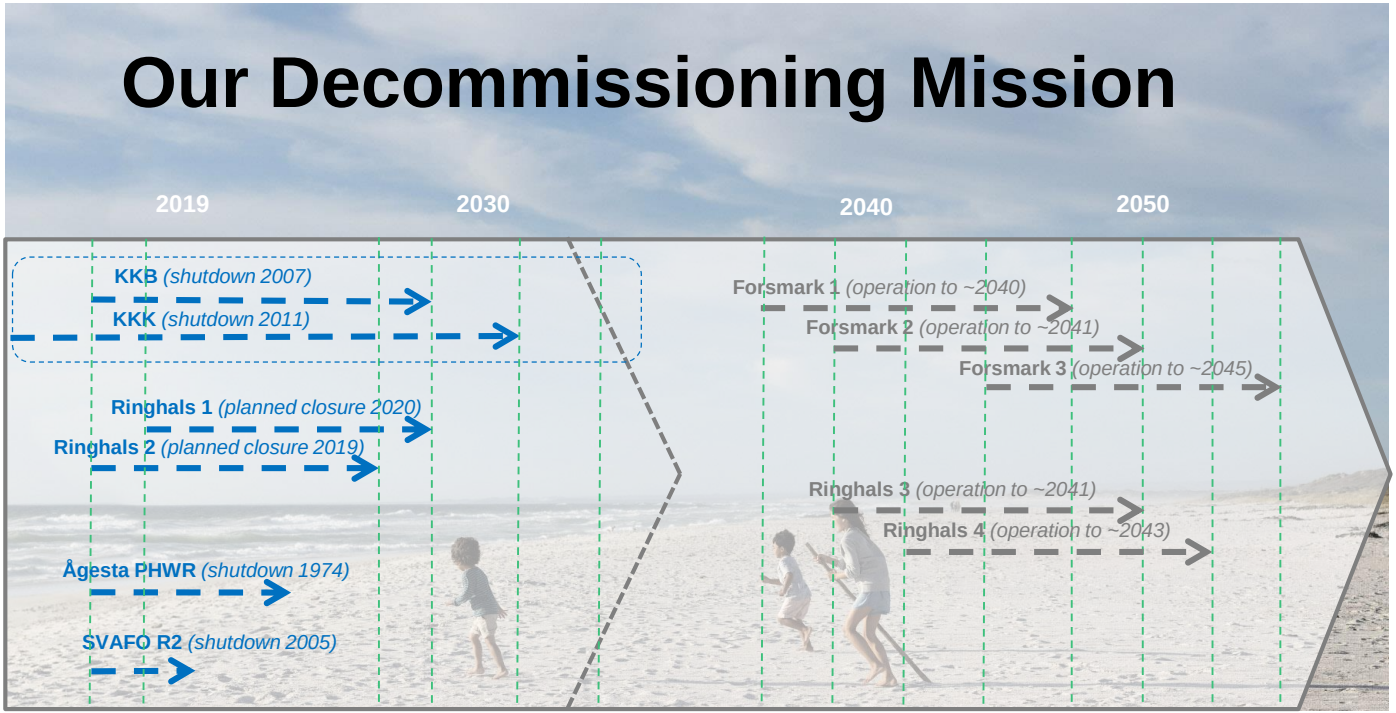
Carbon dioxide footprints

g CO2-equivalents per kWh (distribution excluded)

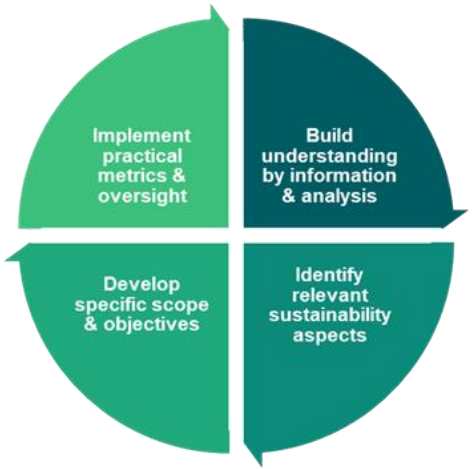


Vattenfall & nuclear decommissioning

Our Decommissioning Mission



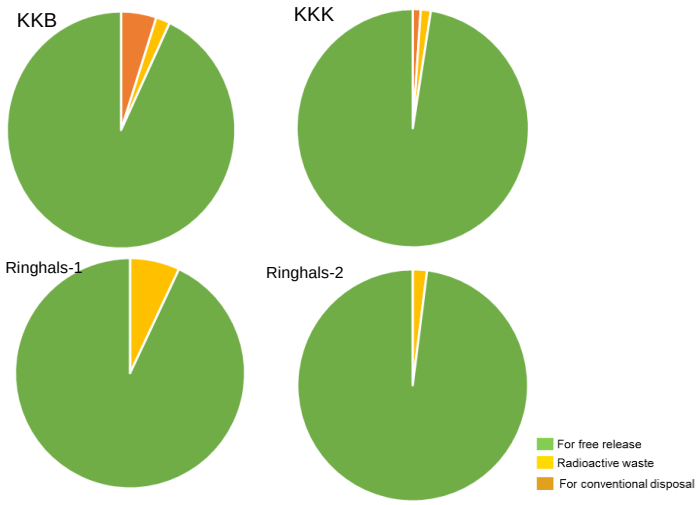
Integrating sustainability in our nuclear decommissioning



- Sustainability requires a **strong & stable platform**
- **Optimal solutions** are sought
  - ➢ Each pillar has to be **strong**
  - ➢ The relationship has to be **balanced and stable**
  - ➢ **Not** a lowest common denominator

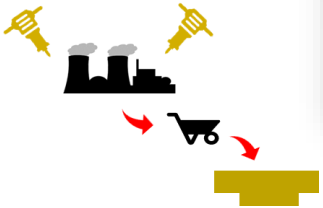
Waste & the circular economy

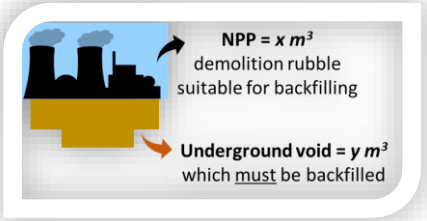
- **Possibilities** created by the large proportion of recyclable materials from NPP decommissioning
- **Constraints** imposed by:
  - Safe & responsible management of radioactive & hazardous materials
  - Availability of alternative management options & infrastructure
  - Interactions between material & waste flow logistics, and other decommissioning activities
  - Schedule & economic considerations

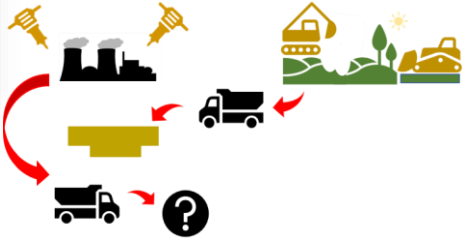


Our challenge - finding the right balances while implementing decommissioning

Reuse of demolition rubble





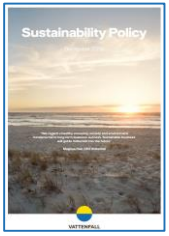


Use NPP demolition rubble to backfill void	
Reuse of demolition material in a necessary activity (backfill)	Consistent with waste hierarchy
No offsite transports of demolition rubble; no or minimal transports of fresh backfill material to site	Avoids unnecessary energy consumption = ↓ CO2, etc
No or minimal need of fresh backfill material	Avoids unnecessary use of raw materials

Use fresh backfill material to fill void	
No reuse of demolition material in a necessary activity (backfill)	Inconsistent with waste hierarchy
Offsite transports of demolition rubble; transports of fresh backfill material to site	Additional energy consumption = ↑ CO_2 releases, etc
Excavation of backfill material	Additional energy consumption = ↑ CO_2 releases, etc; disruption to natural environment
Use of fresh backfill material	Unnecessary use of raw materials

Sustainability in our supply chain

- We recognize the enormous potential for **added value** that our supply chain partners can bring
- We aim to build **mutually beneficial relationships** - helping each other fulfil our sustainability obligations and meet our respective objectives
- Vattenfall encourages this by:
  - Embedding sustainability requirements as part of procurement & contracts
  - Recognising suppliers own sustainability initiatives in evaluating bids
  - Using incentives to empower suppliers to go beyond minimal requirements



Interest in collaboration

- We are at an early stage of development of integrating sustainability ahead of our major decommissioning projects
- Open to learn from others
- Willing to share our experiences moving forward

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Business Unit Nuclear Decommissioning

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