Hitachi Zosen
INOVA

Waste Expo 2022, Melbourne
The future of Energy from Waste (EfW)

Speaker:

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What is Energy from Waste (EfW)
Process Schematic

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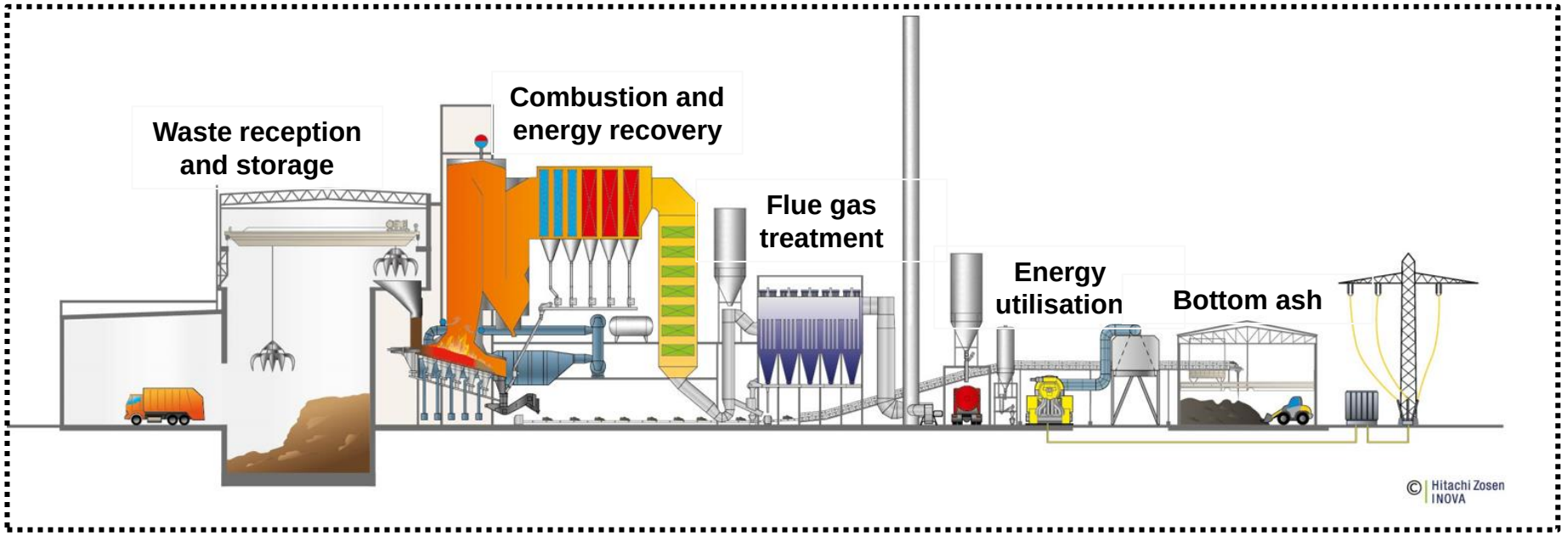
- Residual waste
- Additives for flue gas treatment

Typical Energy from Waste (EfW) grate combustion plant flow scheme



- Cleaned flue gas
- Flue gas cleaning residues
- Energy – electricity and heat
- Bottom ash for recycling

What does an EfW plant look like?
Dublin, Ireland

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Source: https://www.hz-inova.com/projects/

What does an EfW plant look like?

East Rockingham currently in construction, Western Australia

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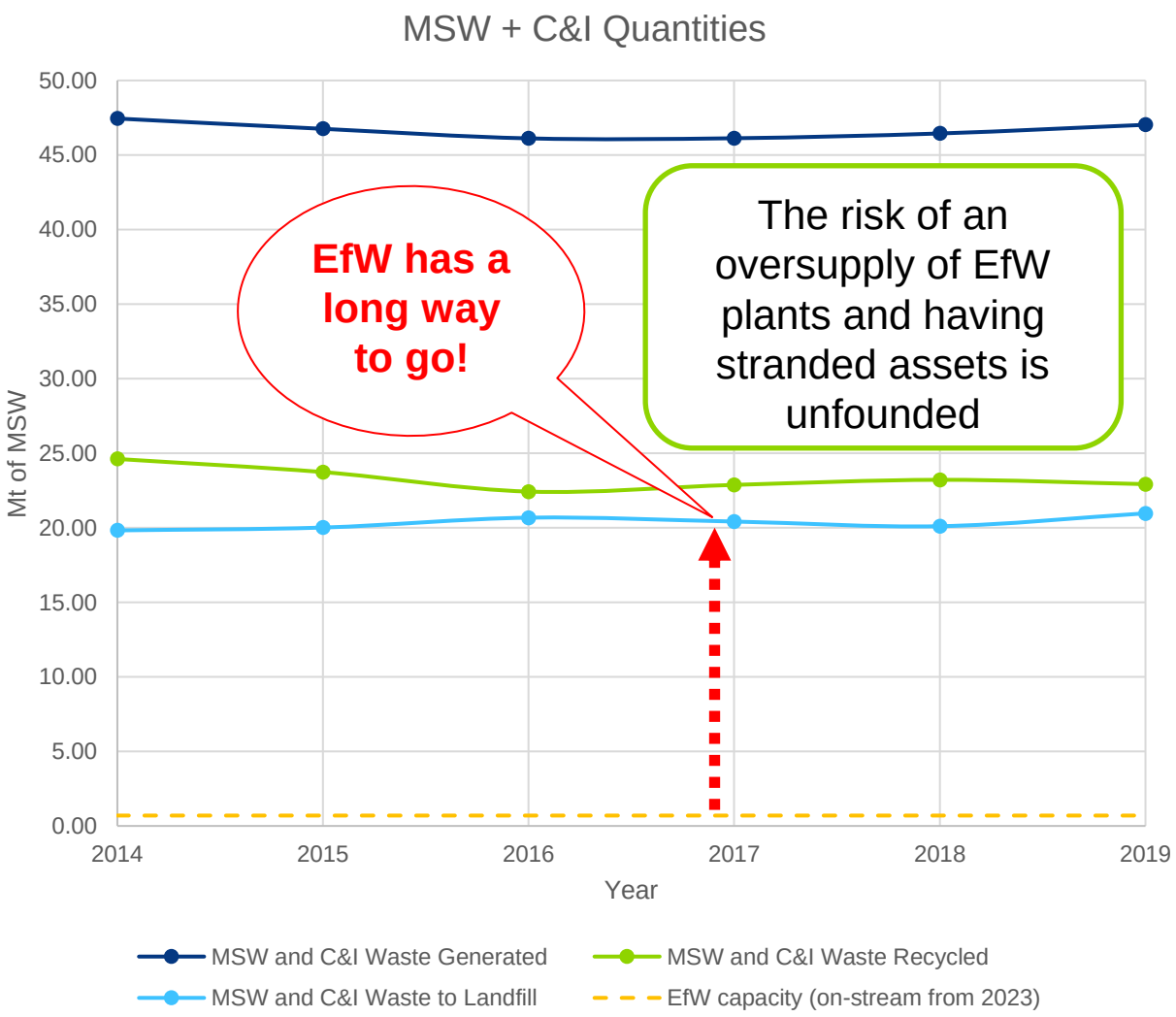
The Australian Context
Waste quantities and EfW plants



- Australia has 2 EfW plants going on-line in 2023:
  - East Rockingham's 300 ktpa plant, WA
  - Kwinana's 400 ktpa plant, WA
- From 2020 National Waste Report data, you need:
  - 70 'East Rockingham sized' EfWs to process residual waste at today's 50% recycle rate
  - 47 'East Rockingham sized' EFWs to process residual assuming we achieve a 70% recycle rate in future
- Landfill capacity constraints around metropolitan centres and increasing landfill levies create commercial drivers for EfW
  - NSW example:

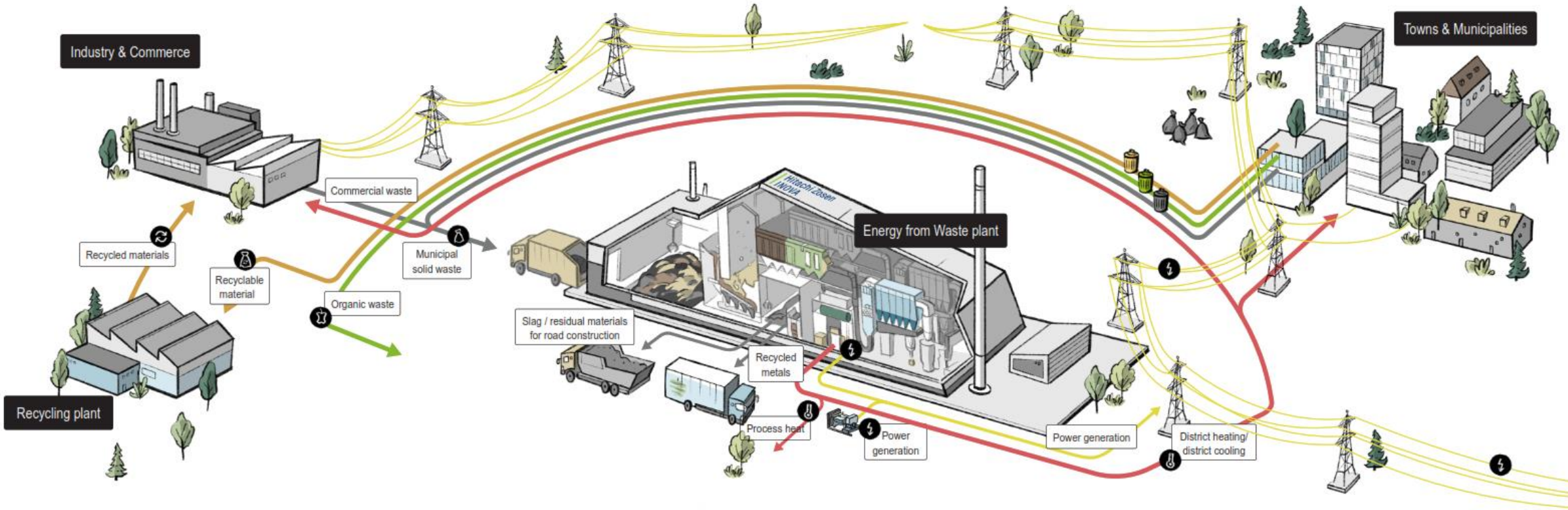
Region	Combined regional landfill airspace expiry
Greater Sydney	Putrescible: 2038 Non-putrescible: 2028

  - Waste levy in metro area incr. 180% over past decade:

$82.20/t (2012) ⟶ $151.60/t (2022)

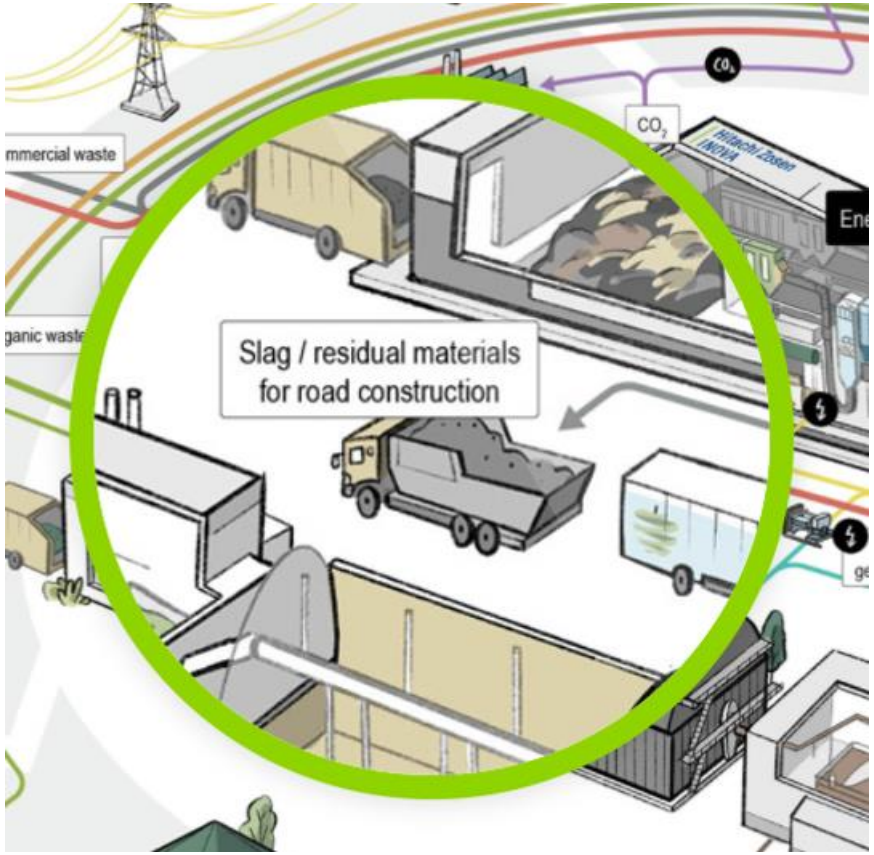
The Future: Step 1

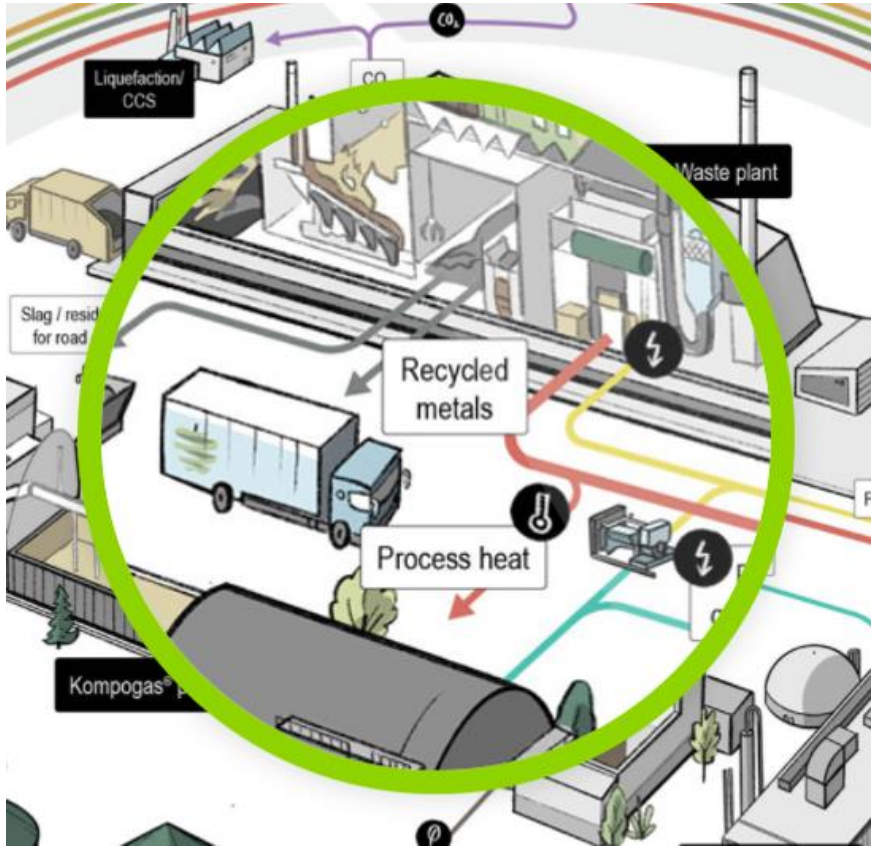
- Separate the organics and recyclables
- Build an EfW for the residual waste



The Future: Step 2

- Recover the metals and bottom ash and reintroduce to the circular economy



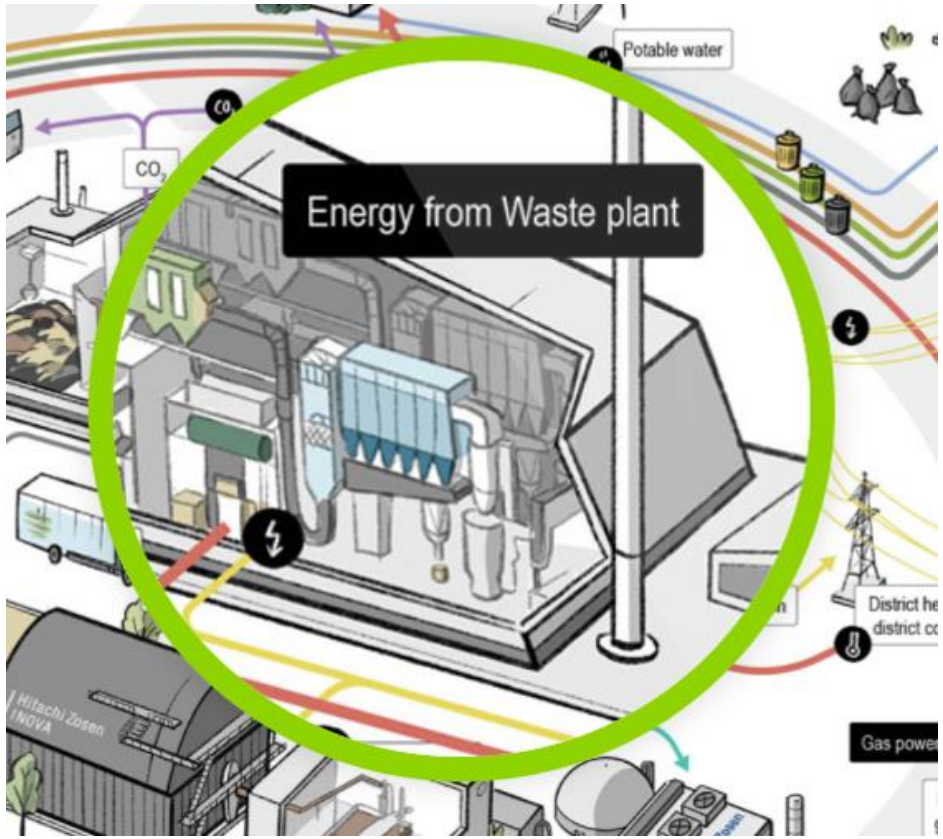


The Future: Step 2

- Opportunities aplenty!

The Future: Step 3

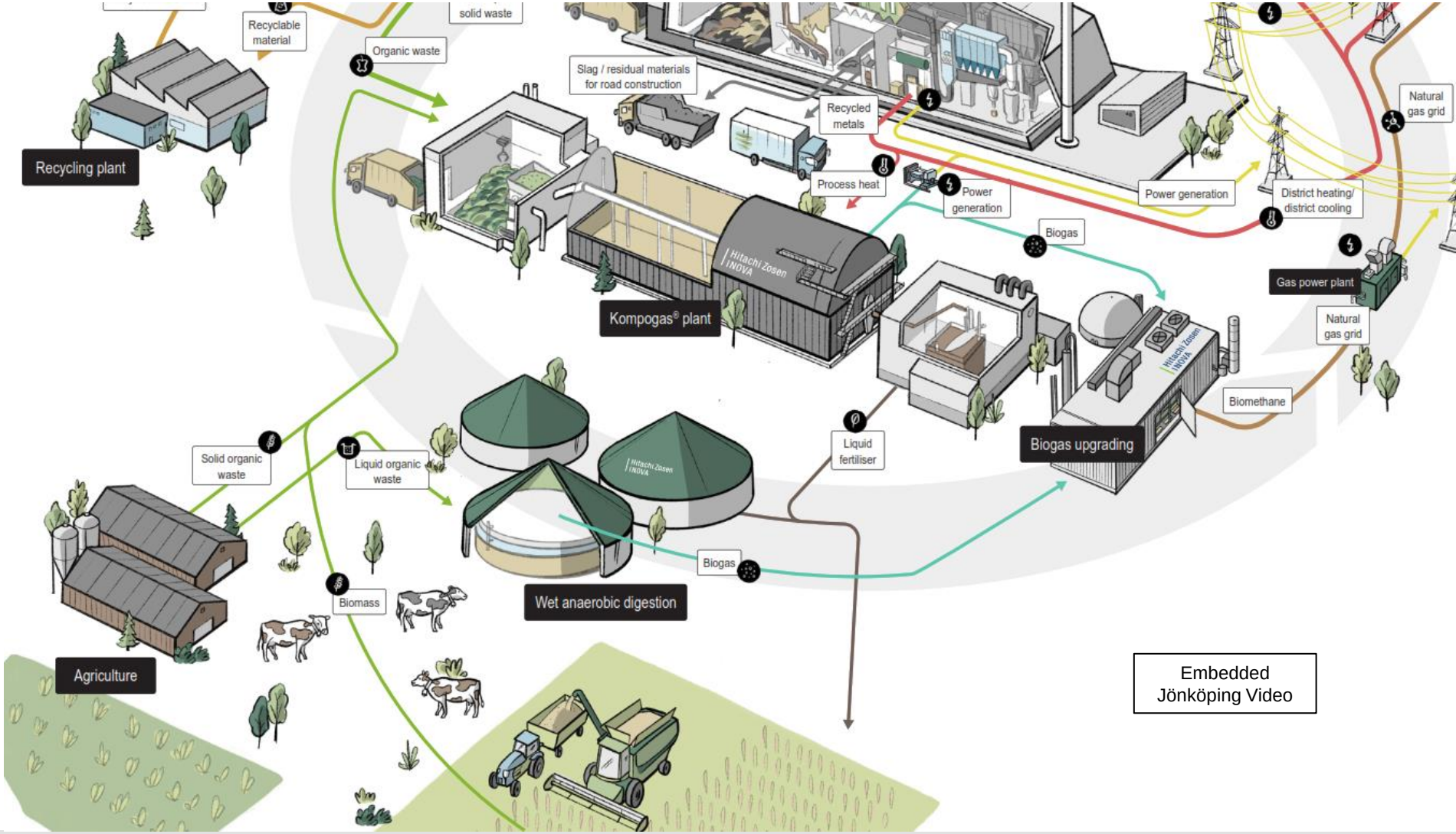
- Recover salts from the ash



- “Salarium Högbytorp”, a flue gas residue treatment facility in construction by HZI at Ragn-Sells Högbytorp recycling facility in Sweden.
- The installation will extract useful materials such as potassium chloride, sodium chloride, calcium chloride salts and ammonium sulphate from the residue.

The Future: Step 4

- Process the organics
- Produce carbon neutral biogas



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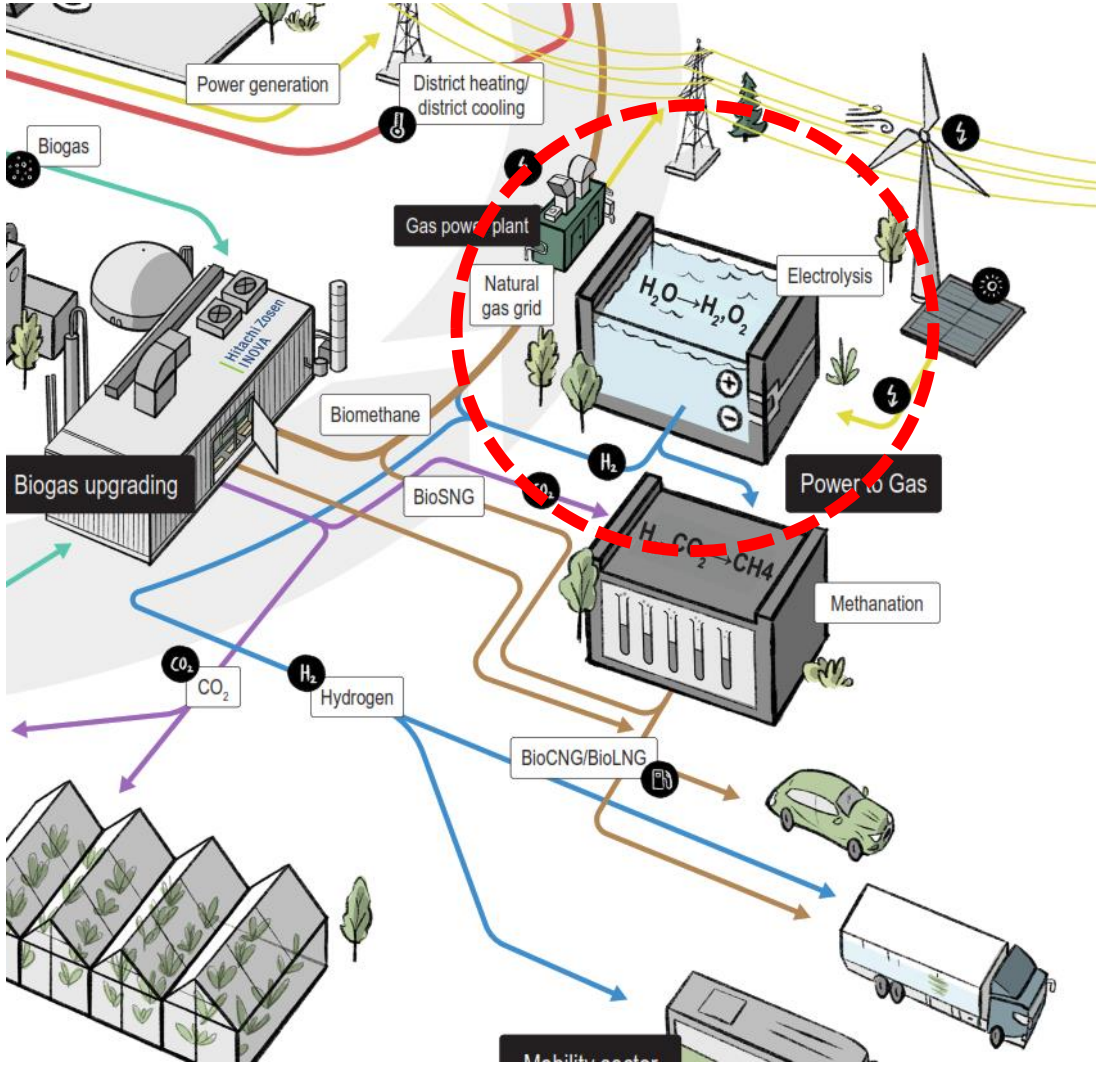
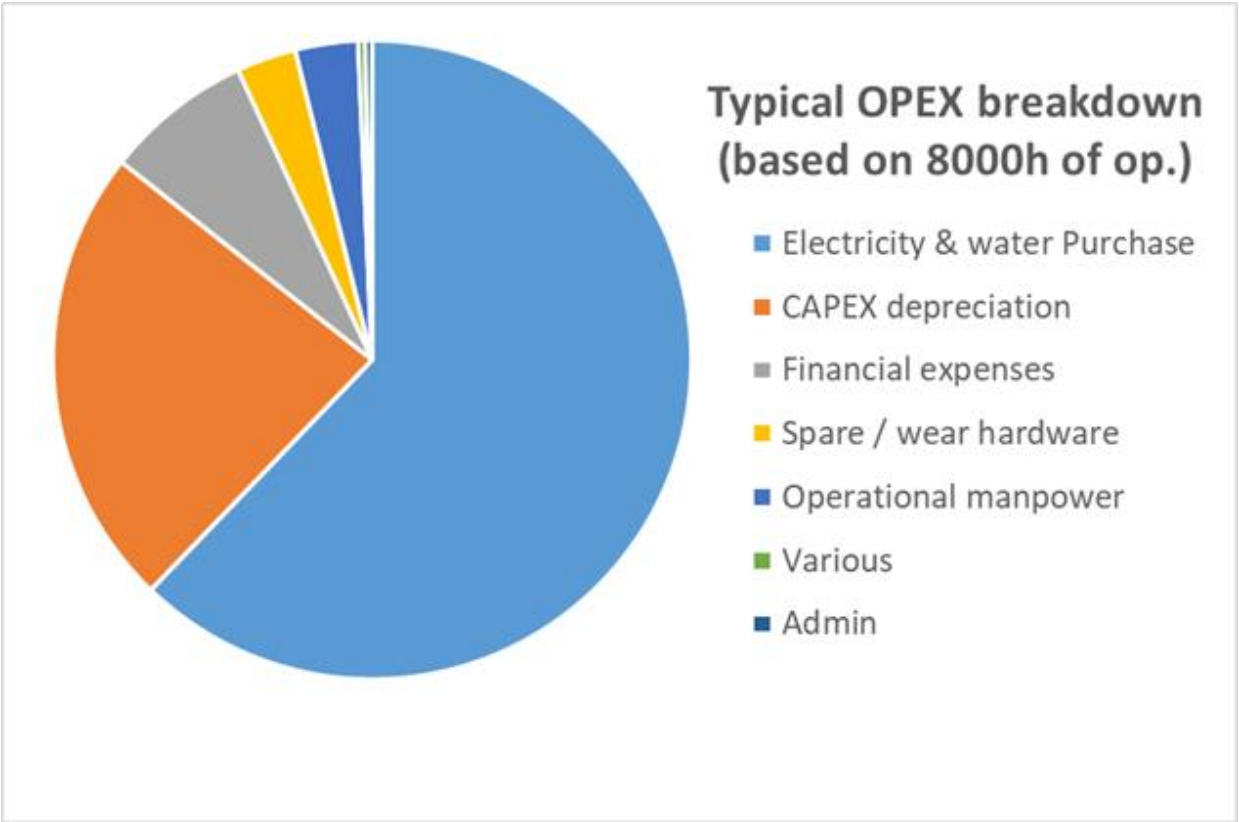
Jönköping Video

The Future: Step 5 - H_2 Production



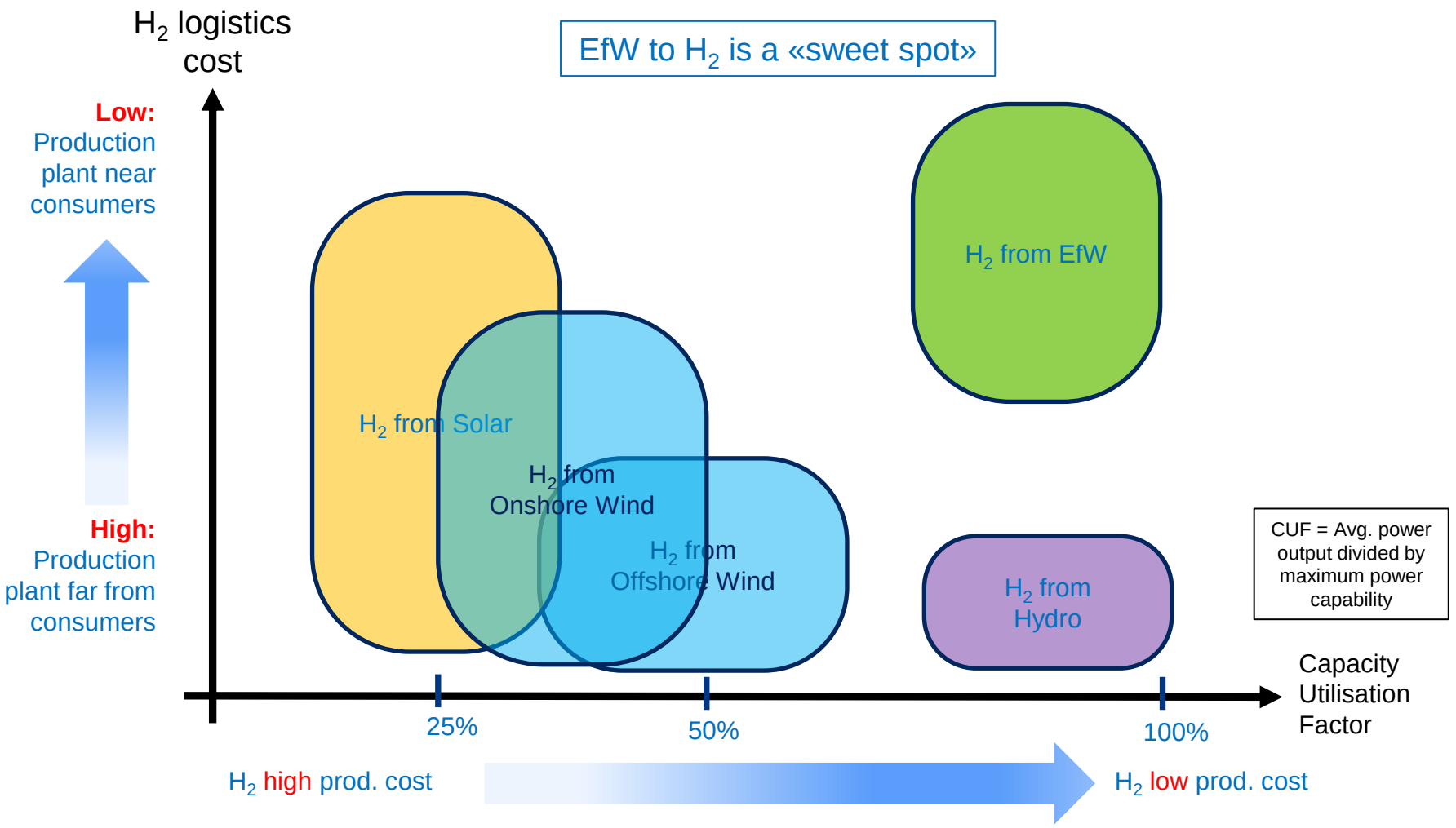
- Key metrics (typical):
  - Inputs: electricity at 2.75 MW per electrolyser module; ~0.7m^3/hr of raw water required (EfW consumes ~5m^3/hr of feed water)
  - Production rates: 50 kg/hr H_2 per electrolyser module.
  - Modular design → scalable as required.
  - Capex: AUD 10-15 mill
  - Small footprint: 15m x 15m per module
  - Can be either base load or fluctuating → production optimised → availability of other renewable electricity generation
  - Contributes to balancing of grid → becomes a facilitator for more renewable energy in the energy mix

H_2 Production - Viability



- **Main contributors**
  - Power price
  - Number of operating hours
  - Power efficiency
  - CAPEX
- **Other factors with less impact:**
  - Operations and Maintenance
  - Consumables, water, etc
  - Civil works, land lease
- **Viability:**
  - Levelized cost of \$1-12/kg H_2 → highly dependant on electricity prices
  - Behind the meter advantage for EfW

Comparing H_2 produced directly from different power sources



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The Future: Hydrogen plant at EfW plant KVA Buchs, Switzerland

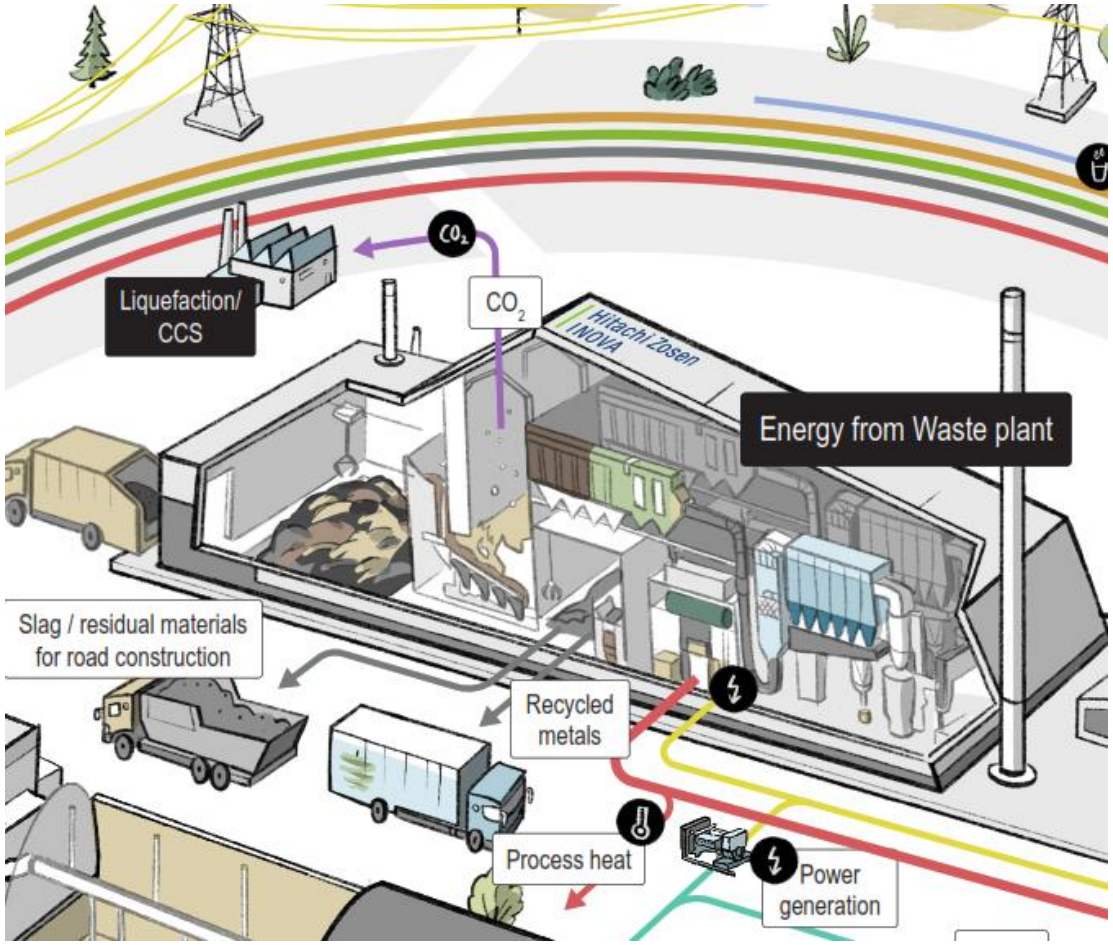
Plant capacity	**2,75 MW**
H_2 production	**550 Nm³/h at 350 bar**
	~ 20mill km/yr H_2 vehicle
Start of Operation	**2023**

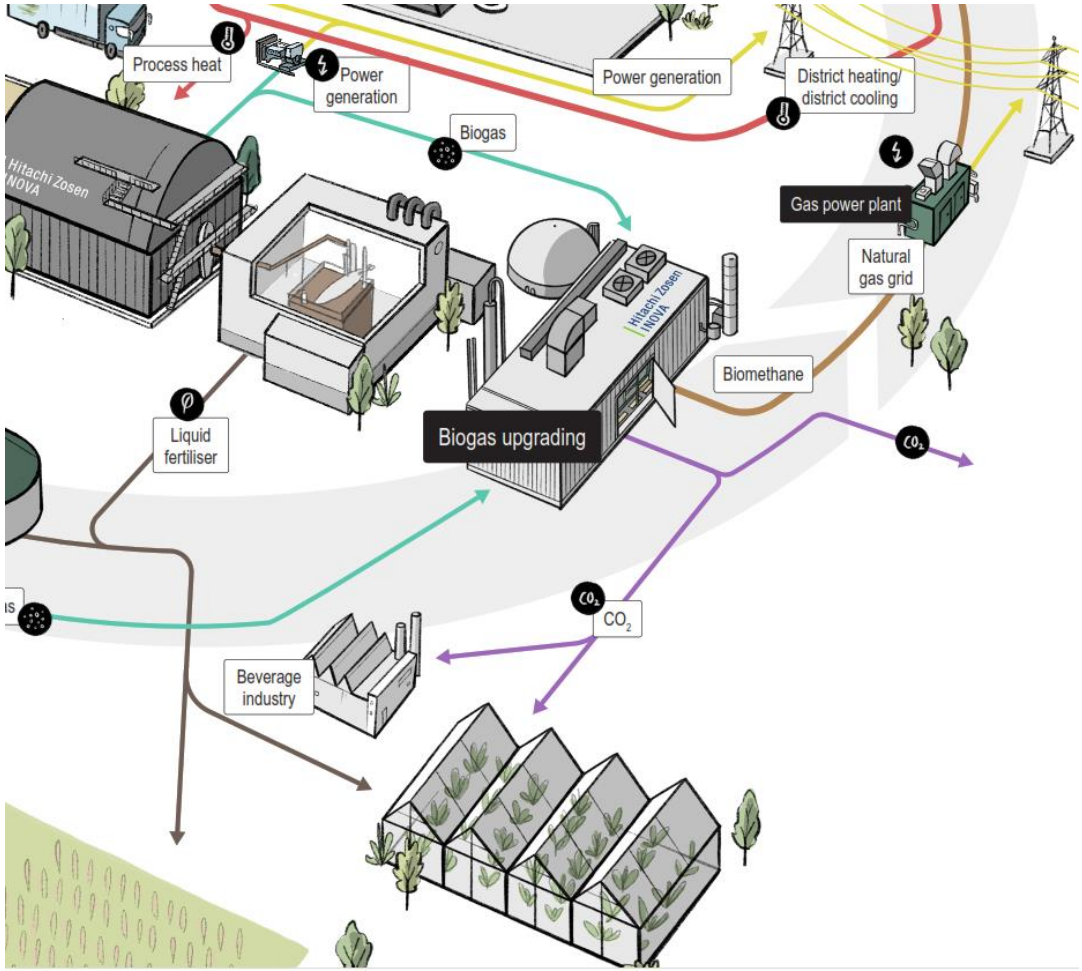
kva buchs aargau

MESSER Gases for Life

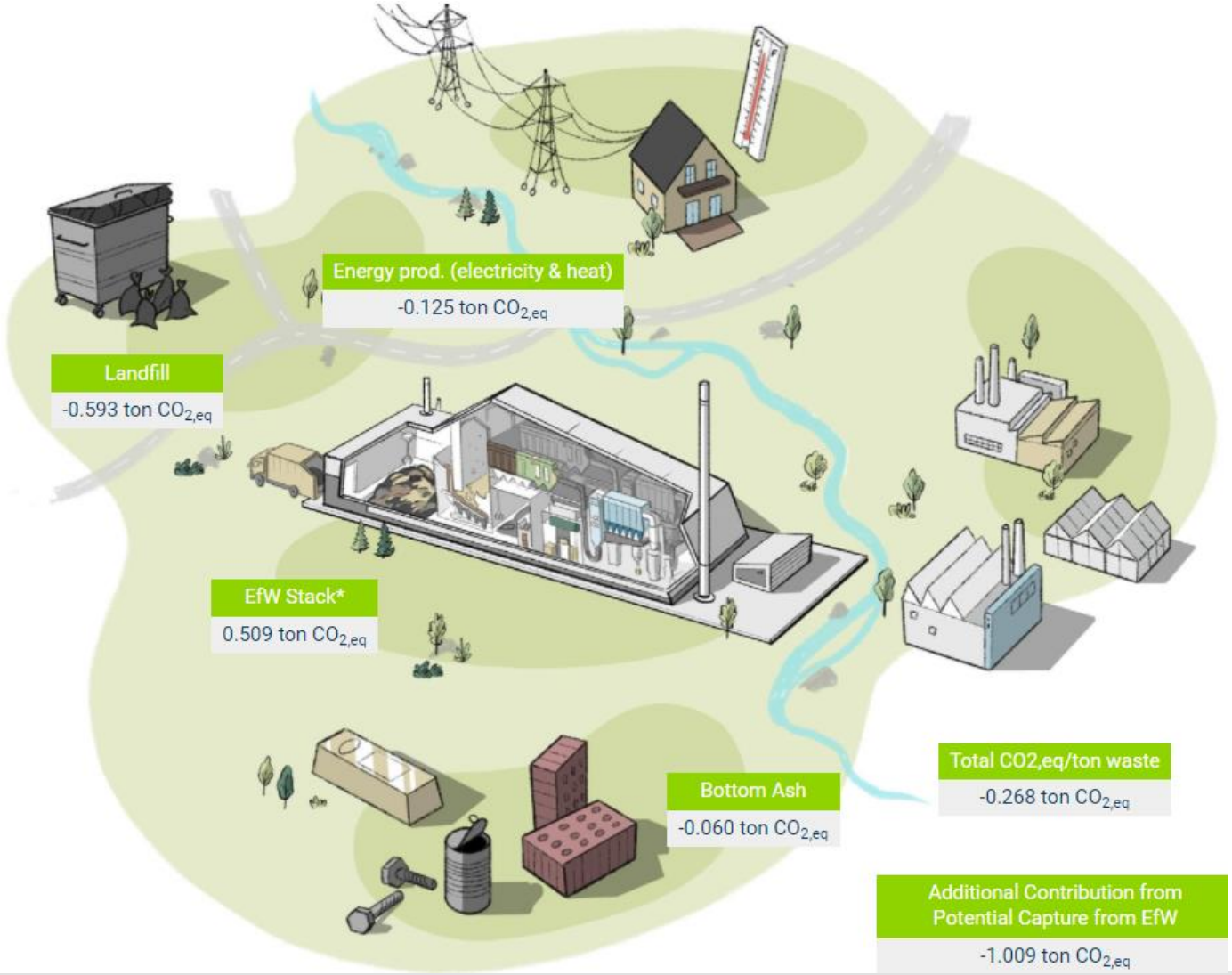
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

The Future: Step 6 – Capture the CO_2



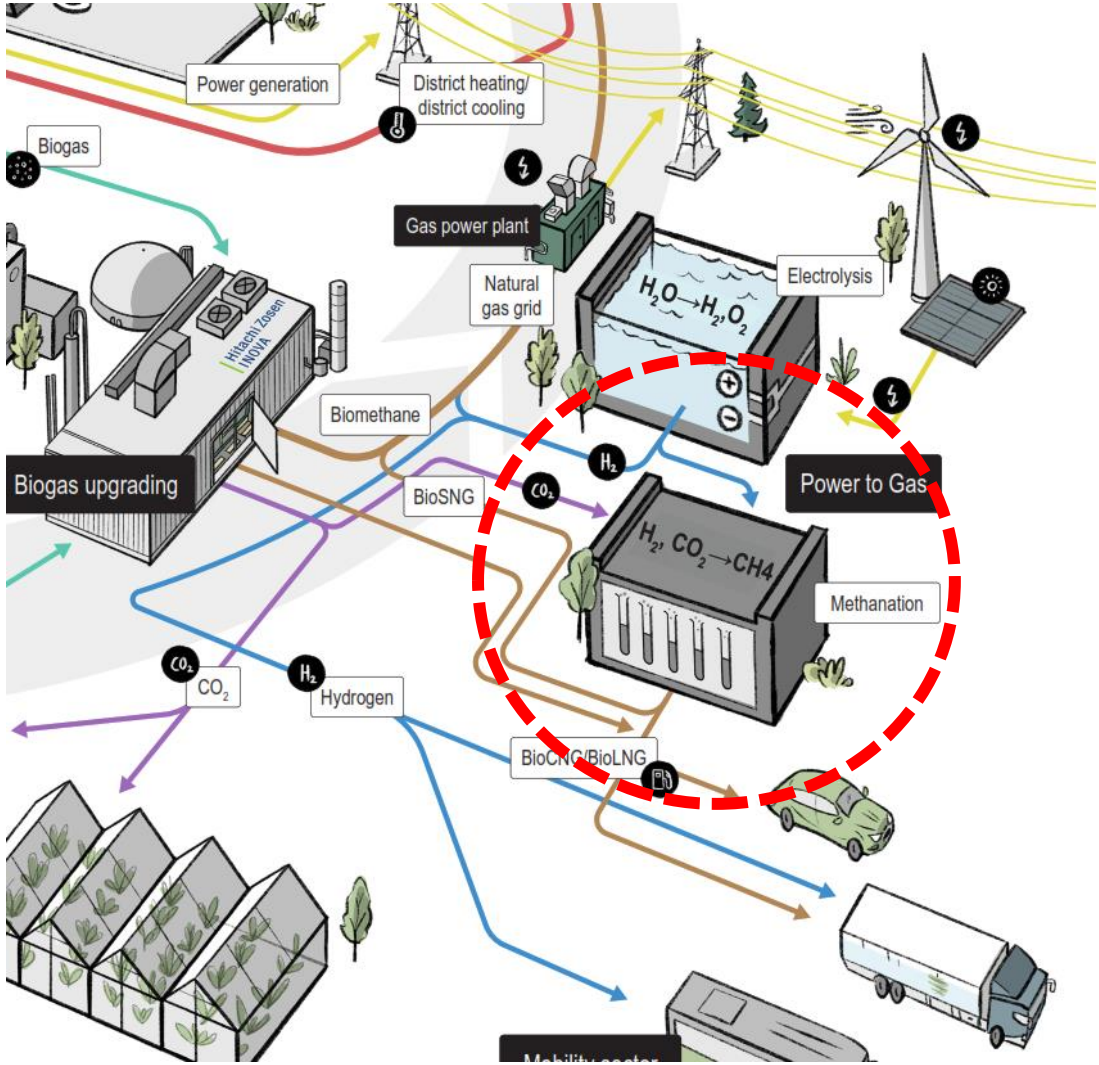


The Future: Step 6 continued…



- Carbon capture will further reduce EfW's net carbon balance
- Up to 1t CO_2eq/t of waste net climate impact through:
  - Landfill diversion
  - GHG avoidance from virgin metal mining and production
  - Fossil based energy offset
  - Recovery of CO_2 captured from the EfW stack.
- Numerous carbon capture demonstration unit installations currently underway in Europe

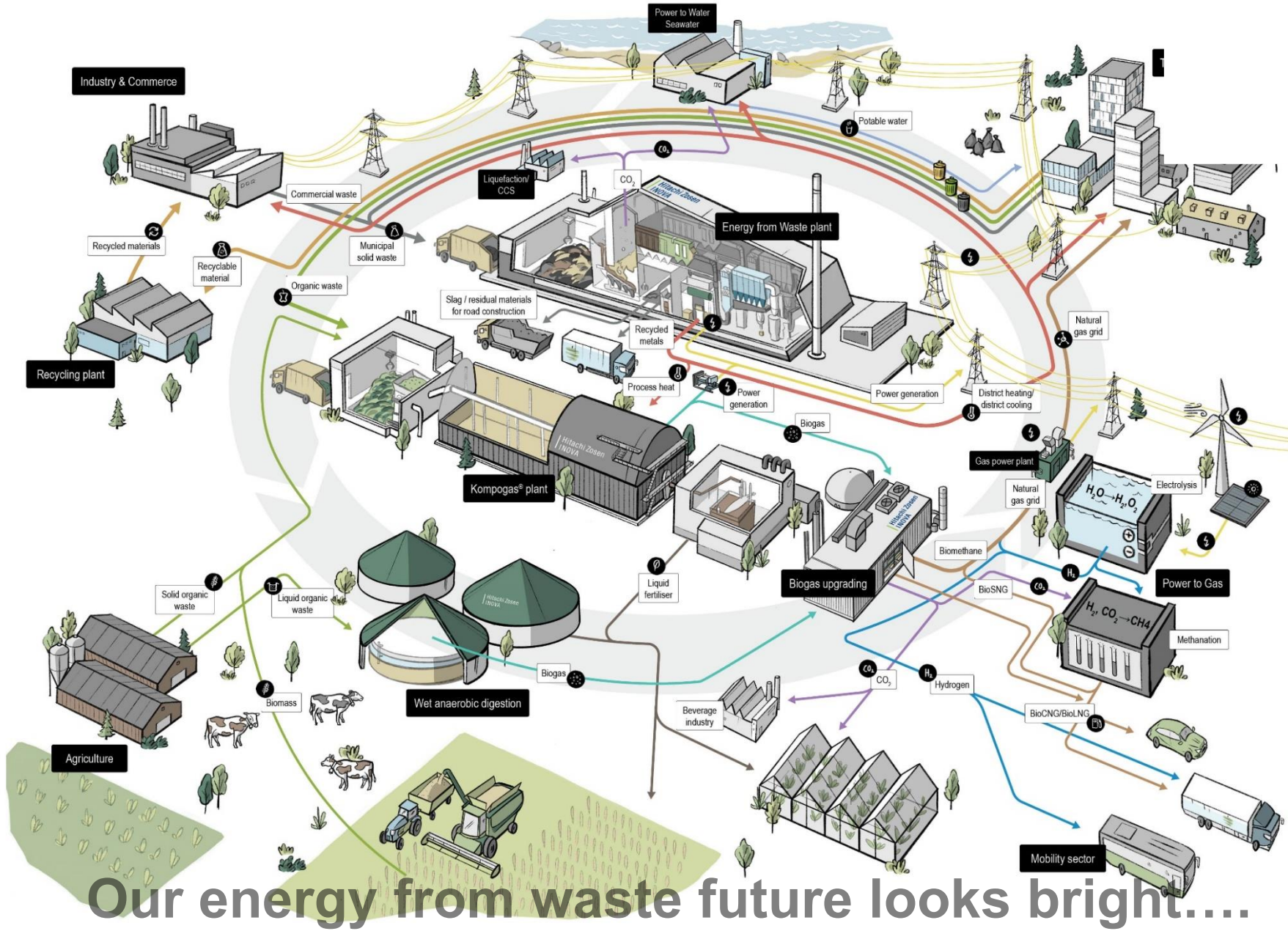
The future: Step 7 - Combine H_2 and CO_2 to produce methane



- Methanation key metrics (typical):
  - Inputs: H_2 and CO_2
  - Input = 6000 Nm3/hr total feed. Ratio typically $4H_2$:$1CO_2$
  - Output = 1240 Nm^3/hr (~45 GJ/hr) of methane. Scalable as required.
  - Unit cost: AUD 12-18mill
  - Space requirements: 25m x 30m per module

Step 7: Continued…

- Methanation demonstration plant designed, co-funded and constructed by HZI: Inpex, Japan
- In operation since 2019 with 8Nm3/hr of methane production
- New facility of 400 Nm^3/hr scheduled for start-up in 2024.



Our energy from waste future looks bright….

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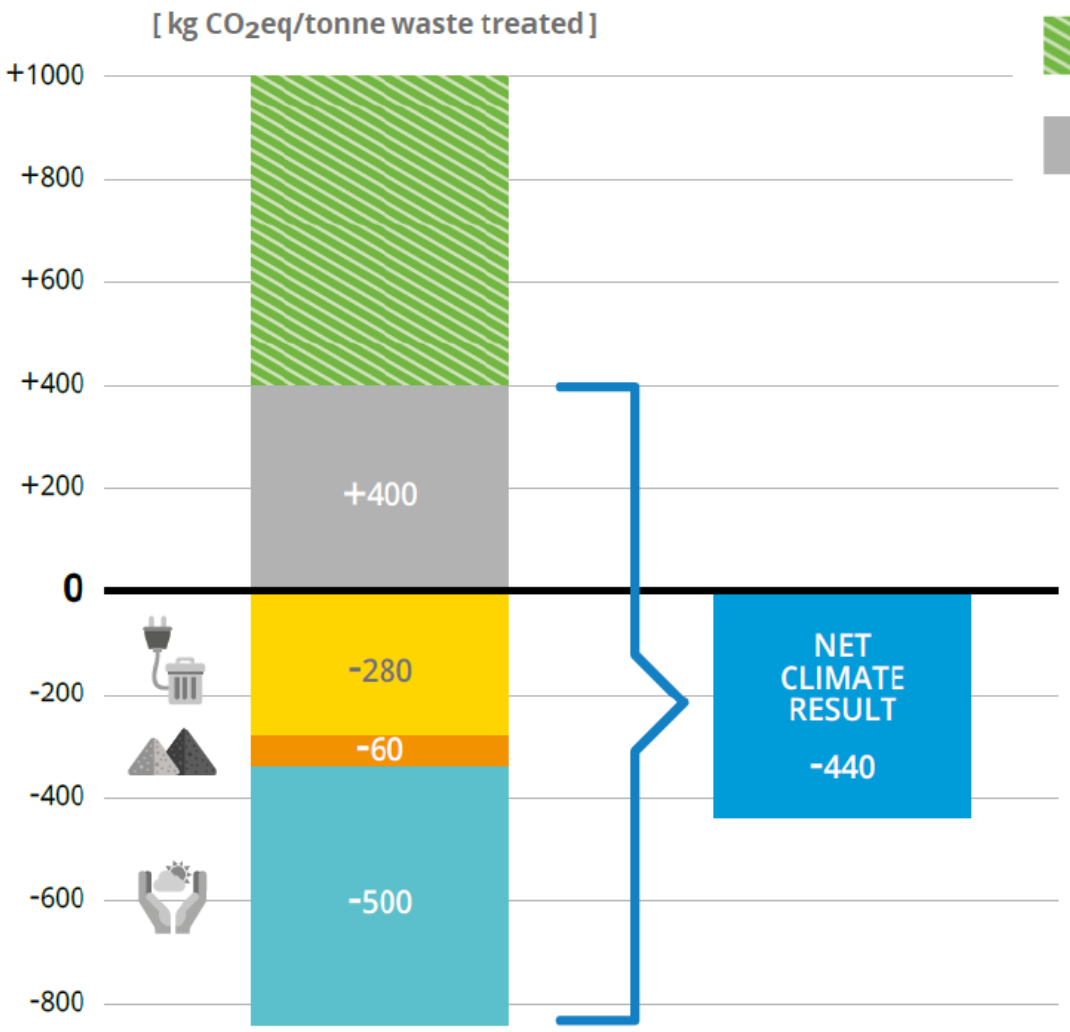
Thank you for your attention

The Future: Step 6 continued…BACKUP



- Carbon capture will further reduce EfW's net carbon balance.
- A 50% CO_2 capture rate → 440 kg CO_2eq/t net climate impact.
- A much higher positive carbon impact if landfill diversion is considered.
- Numerous carbon capture demonstration unit installations currently underway in Europe

Source: CEWEP - 21 June 2022, Path to Net Zero: Is Waste-To-Energy Part of the Solution? https://www.cewep.eu/