

MESIA ATA Webinar

September 2nd 2020

Decarbonization opportunities through Green Hydrogen: Mining, Steel and Transport



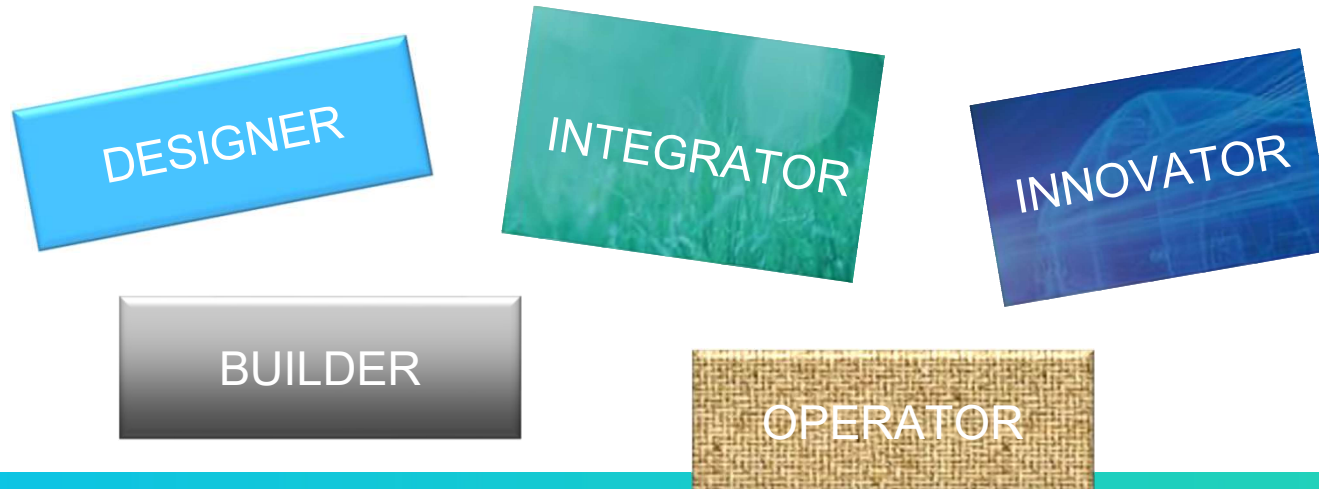
Christophe COMTE
SVP Business Development H2

Who are we?

ENGIE Hydrogen is a specialized business unit created by the ENGIE Group.

ENGIE Hydrogen is a **global energy solutions designer** that develops, builds, operates, manages Hydrogen systems using renewable sources throughout the value chain to deliver a smooth zero carbon transition.

We serve customers in diverse sectors including industry, large off-grid ecosystems, grids services (gas, electricity, heating & cooling, storage, electrolysis), mobility and logistics.

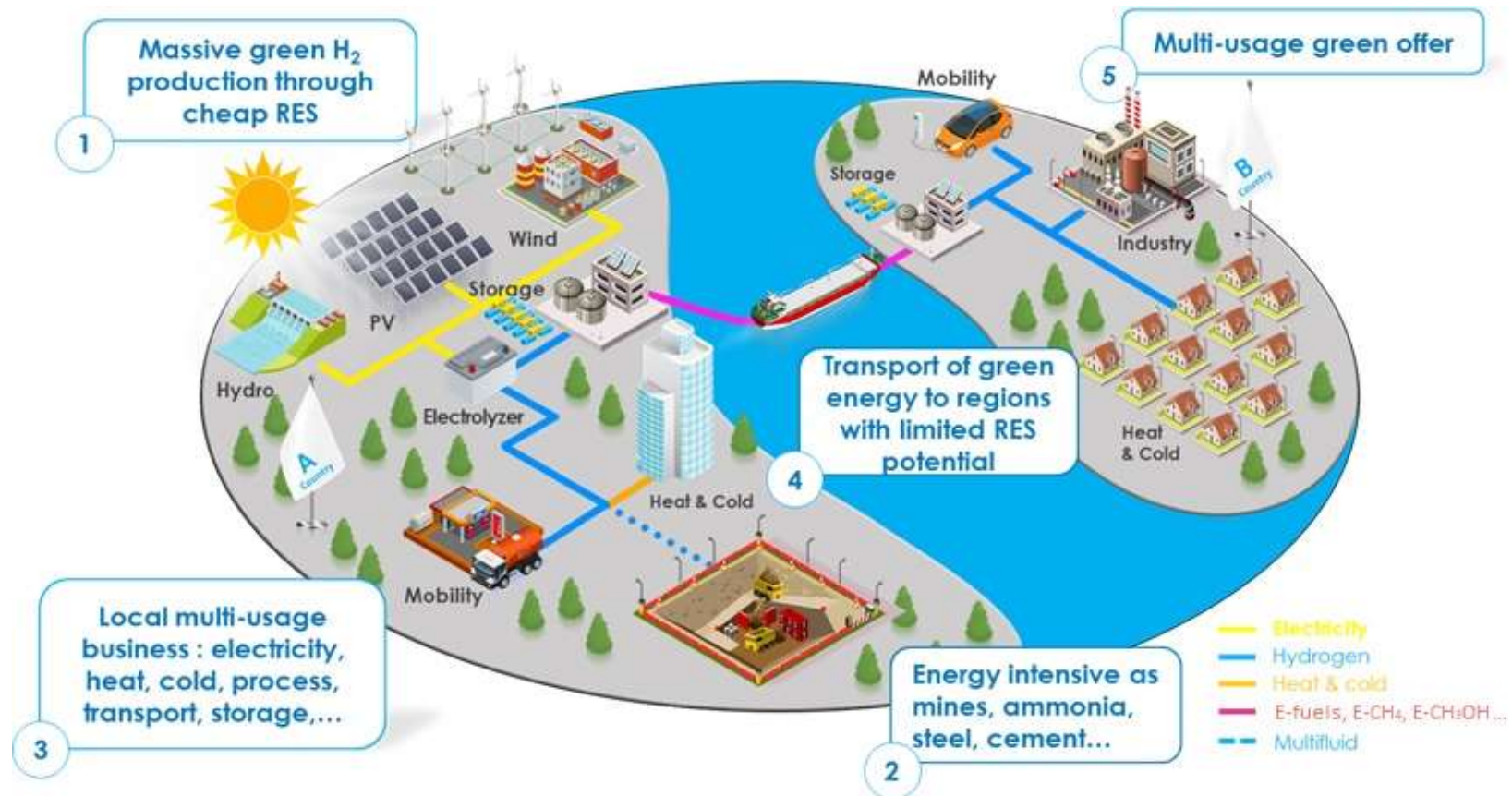


Our Ambition



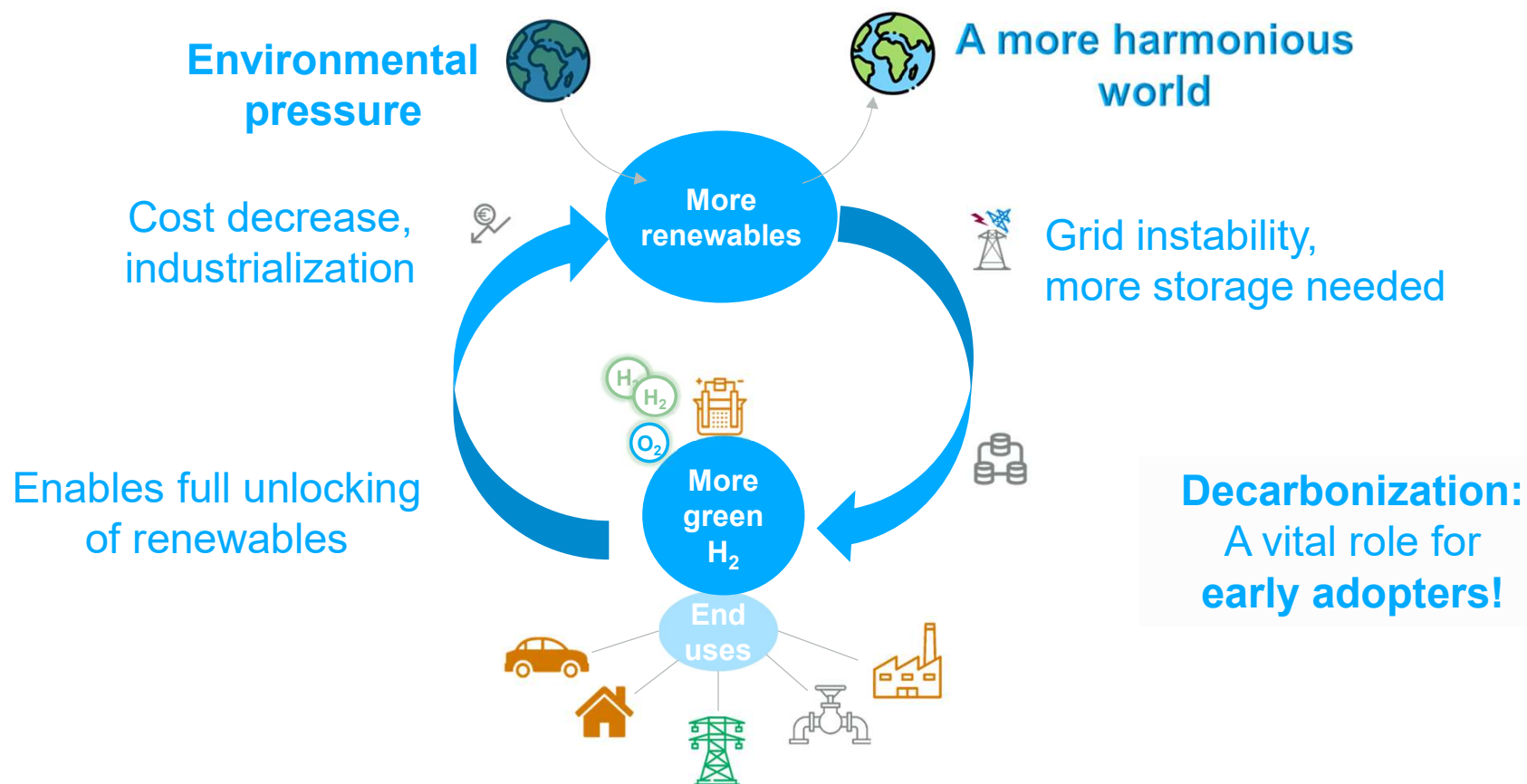
*To become a major player in **renewable Hydrogen**, to be a front runner in the upscaling of the Hydrogen economy **to enable a zero-carbon energy transition** across diverse industry segments.*

ENGIE's vision on H2 Economy



We need early adopters

Virtuous circle between scale and cost reductions

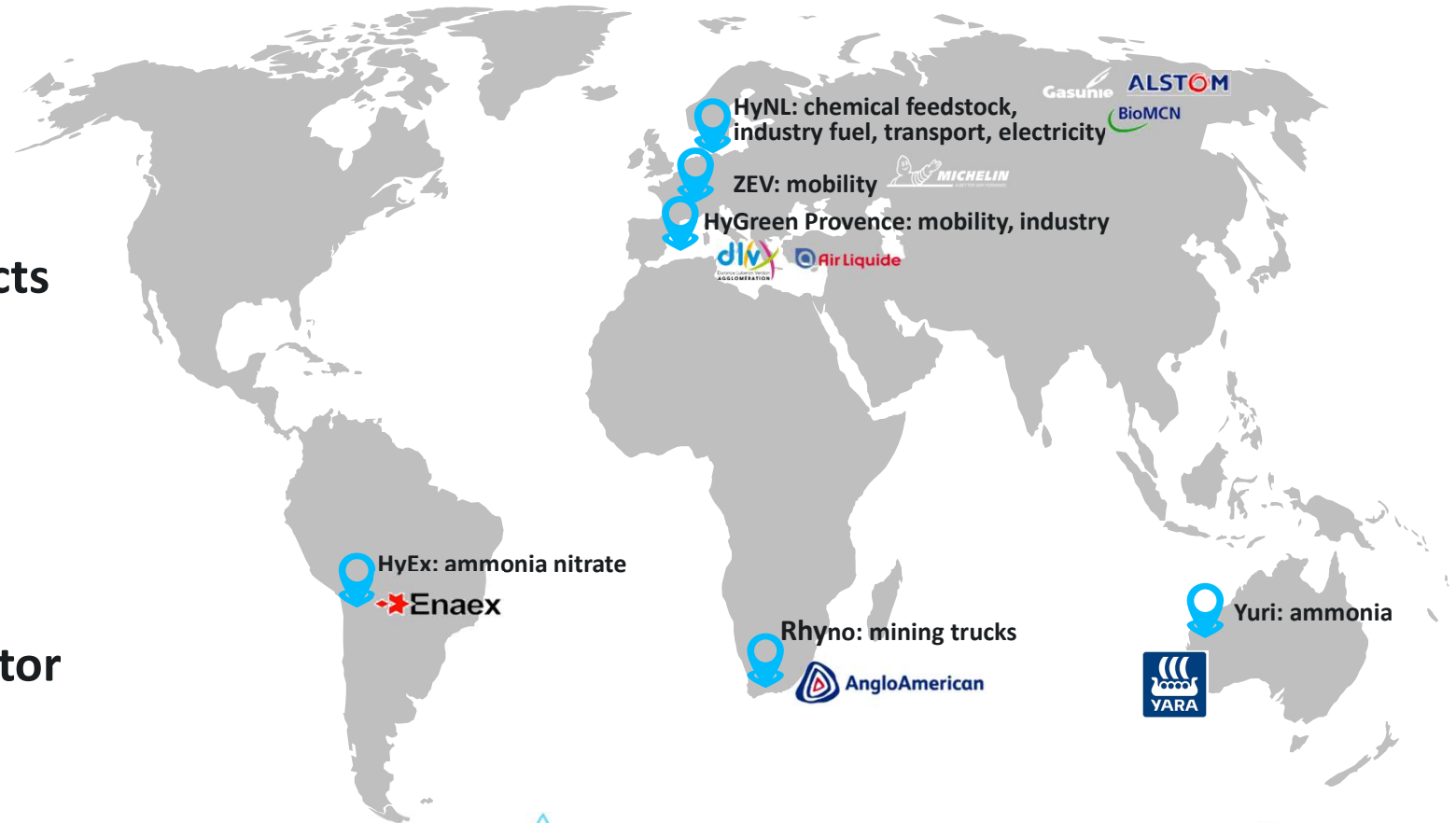


ENGIE IS Committed & In action

Walk the Talk

Industrial-scale projects

Demonstrator projects



PpP
Pau Portes des Pyrénées
Ville de Pau

HYNOVAR
L'hydrogène, l'énergie du développement local

SMT
Syndicat Mixte
des Transports
Artois-Gohelle

METHYCENTRE

HY PORT

GRHYD
Région Hauts-de-France

EffiH₂
by ENGIE

Jupiter

**What about
GREEN MINING ?**

Engie's solutions for the Mining Industry

Engie's full spectrum of solutions, which can be tailored to your needs.

Energy Supply

1. Corporate PPA (solar PV, wind, hydro)
2. Onsite renewable power generation
3. Storage and power quality solutions
4. Energy Management System
5. Transmission lines & substations, HV, MV or LV distribution networks
6. Hybrid power systems
7. Tailor-made global offer for power assets (including design, build, finance, O&M, EPC contract...)

Decarbonization & CSR

18. Carbon footprint: management & reporting
19. Environmental monitoring & consulting
20. Energy access for communities
21. Green mobility: access to electric mobility
22. Consulting on social project acceptance

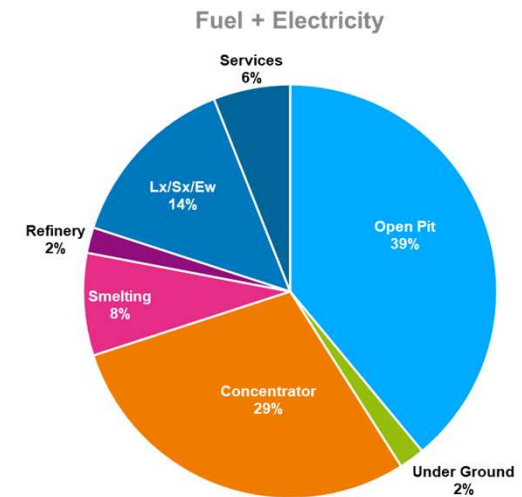
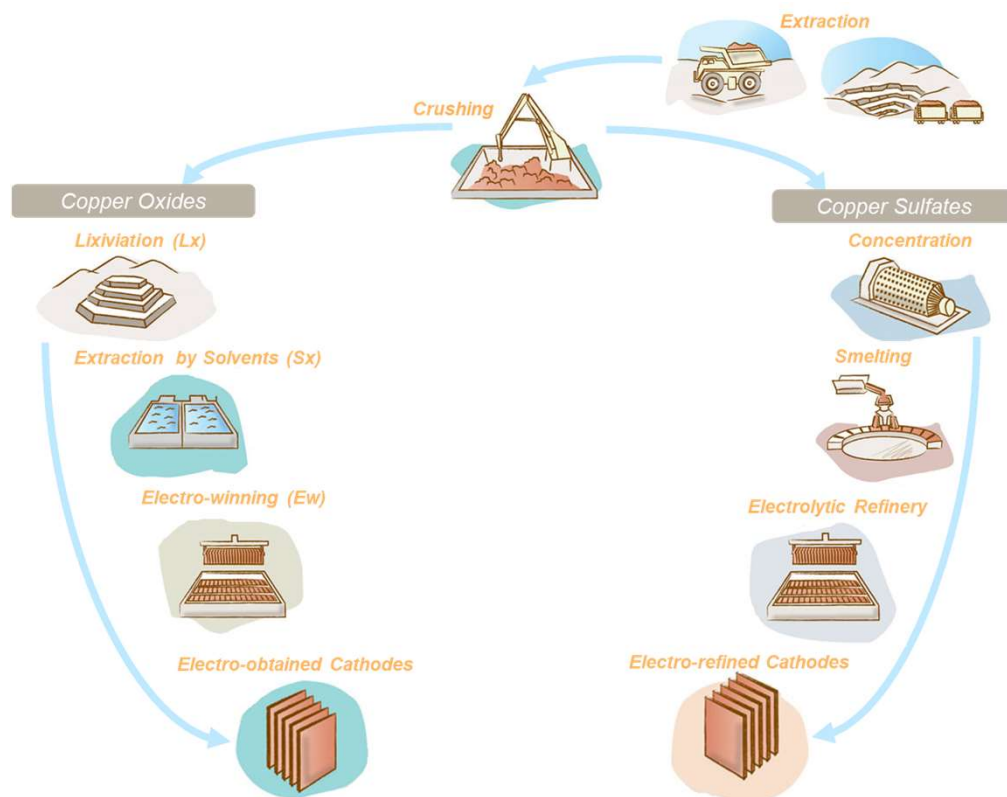


Performance in Mining Operations

8. Electrical engineering, automation system (design, build and maintenance)
9. Utilities production: heat, steam, compressed air, demineralized water (design, build, maintenance and finance)
10. Water production (pumping / desalination units), pipe networks, waste-water treatment
11. Energy supply, energy efficiency (audit, smart monitoring, dashboard)
12. Industrial maintenance, FM
13. Smart management / Data driven O&M : SCADA, production optimisation, predictive maintenance...
14. Safety and security: access control, CCTV, fire protection, alarm systems, security hypervision platform
15. HVAC, tunnels Ventilation and Refrigeration systems (design, build and maintenance)
16. Alternative fuels for mining vehicles (electricity, hydrogen)
17. Hydrogen optimized ecosystem for mines: heavy mobility, high temperature process and power storage

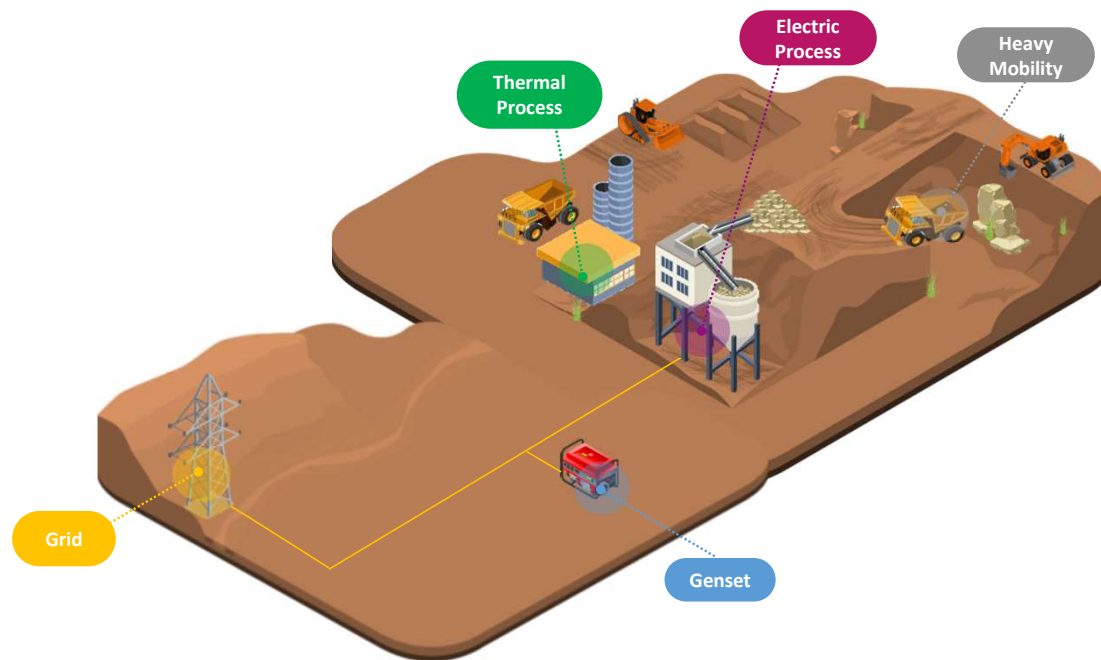
Joint Energy Analysis

..., understand the different processes and how they consume energy,...



Joint Ambition = Green Mining

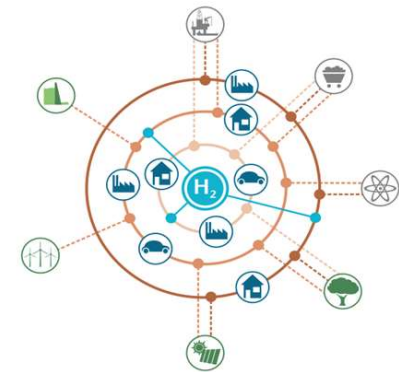
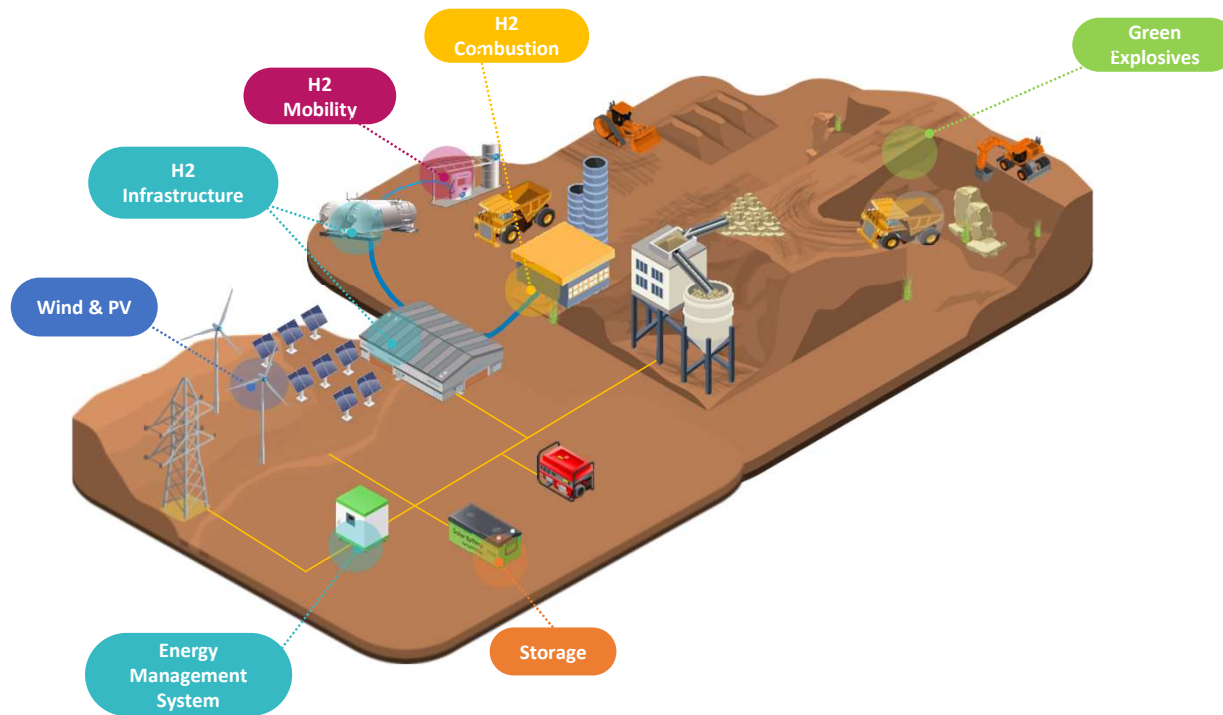
Engie to enable roadmap towards green mining, by offering energy transition as a service, ...



I. Current Situation

Joint Ambition = Green Mining

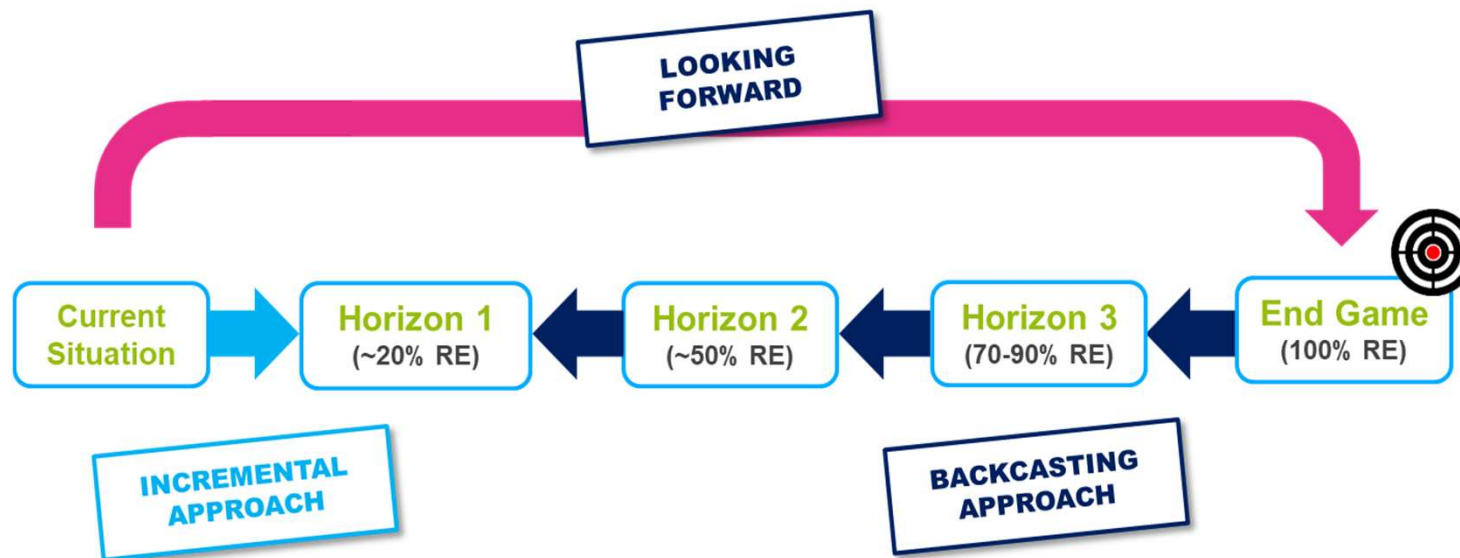
Engie to enable roadmap towards green mining, by offering energy transition as a service, ...



- I. Current Situation
- II. Add Renewables
- III. Add Battery Storage
- IV. Integrate H2 Storage
- V. H2 as Energy Vector

Backcasting Approach

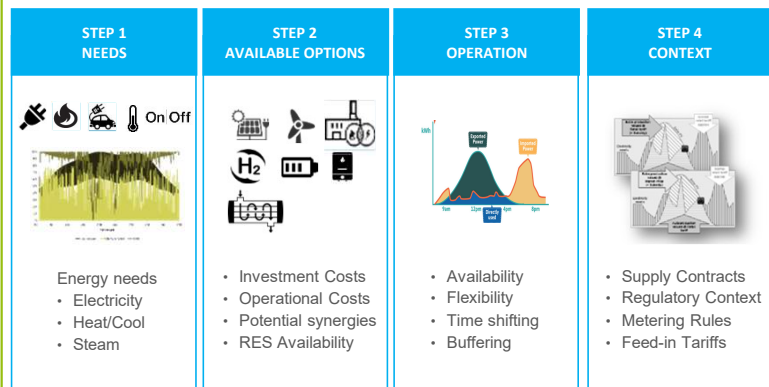
...analyzing which steps need to be taken to reach the end game...



A 360° Approach

... via a techno-economic assessment for multi-fluid & fleet complex energy applications ...

IN-HOUSE TOOL & APPROVED METHODOLOGY



ONE SINGLE SITE APPROACH

ACCESS TO THE GRID

Buy/Sell Electricity
Services to grid operator
Or off-grid

PVs, WIND & INVERTERS

DC (or AC) Inverter optimisation
Subsidies & support schemes

GENSETS

Optimal combination between
gensets sizes, Efficiency
curves, Start-up costs

BATTERIES & HYDROGEN

Fixed costs for engineering,
cooling system, electronics,
hardware, container.
Grid stability module



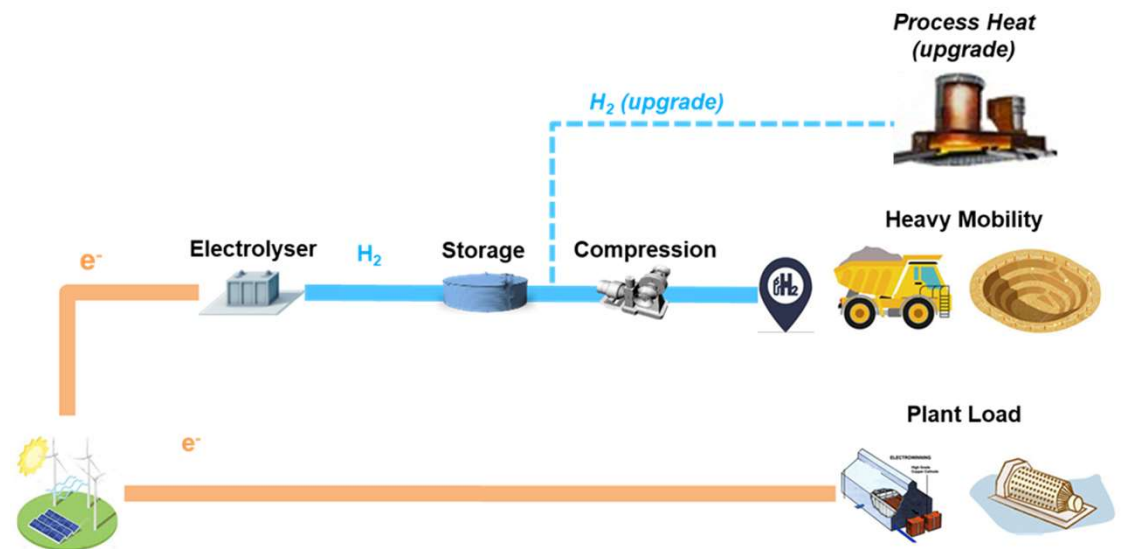
INCLUDING NEIGHBORHOOD SYNERGIES

OUTCOMES

- Optimal size, RES share, LCOEs, Heat cost
- Investments needed (on or off site)
- ROI, Payback, NPV,...
- Savings on energy bill
- Avoided CO₂ emissions
- Operating regimes

Co-Creation

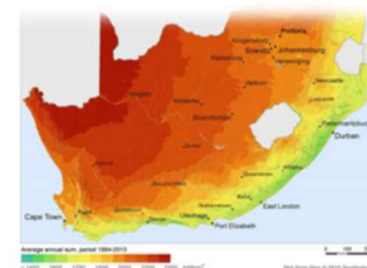
...co-developing H₂ solutions, starting with a minimum viable product per end use, up to replicable and scalable solutions, sharing risks and benefits,...




ENGIE | Anglo American (Rhyno) Project Overview



- Co-developer: **Anglo American** in South Africa
- Purpose: Co-create the **first hydrogen-powered mining haul truck**
- H2 usage: energy for **fuel cell-based powertrain**
- First milestone: first truck in motion in **2020**
- End game: **industrialization** of the solution
- Current status: in **construction**



A large yellow mining truck is shown from a low angle, carrying a massive pile of grey rocks in its bed. The truck is on a dirt road in a mining area, with a steep, rocky hill in the background. The sky is filled with dramatic, orange and yellow clouds, suggesting a sunset or sunrise. The sun is visible as a bright, glowing orb behind the truck's load.

***Let's continue the journey
together !***



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