



# Continuous Mining – Opportunities for more sustainable mining

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# Agenda for this session

1. RWE TI - Who we are
2. Carbon / GHG Reduction through Utilization of Continuous Mining Equipment
3. Summary - Conclusion



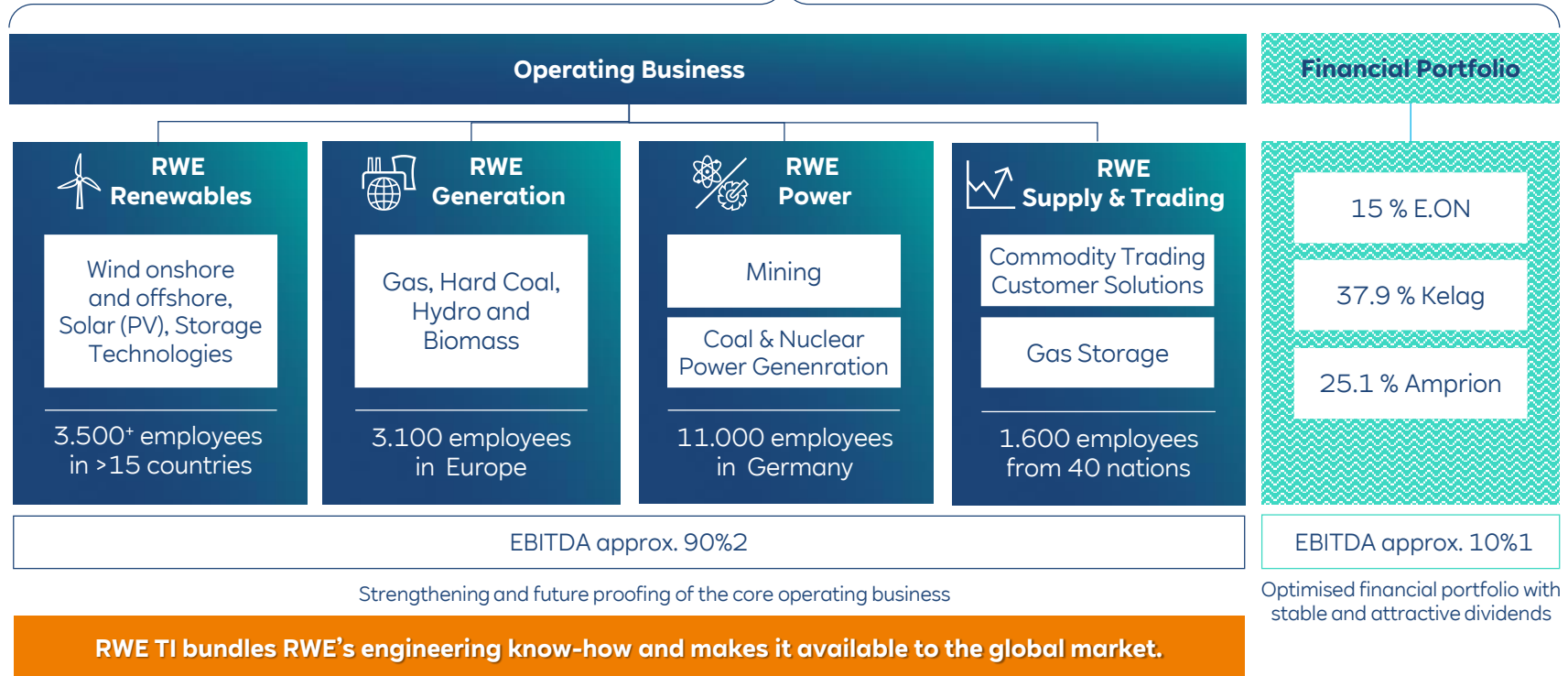
# RWE Technology International

## 1. Who we are



# RWE TI is your gateway to the know-how of the RWE Group.

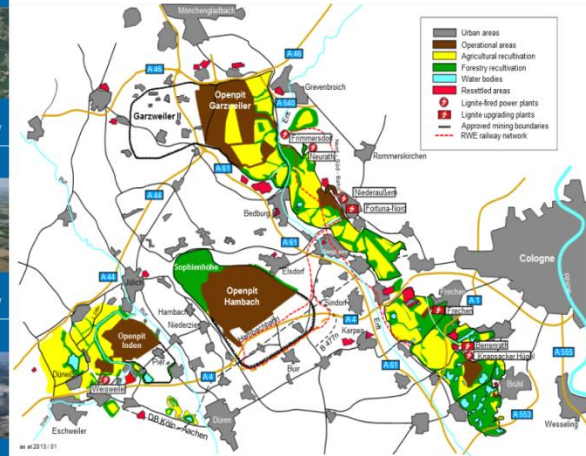
## RWE



<sup>1</sup> Expected future share of adj. EBITDA.



# RWE TI's proven operational experience in CME



**Maintenance Center**

maintenance of big machinery  
technical support / development

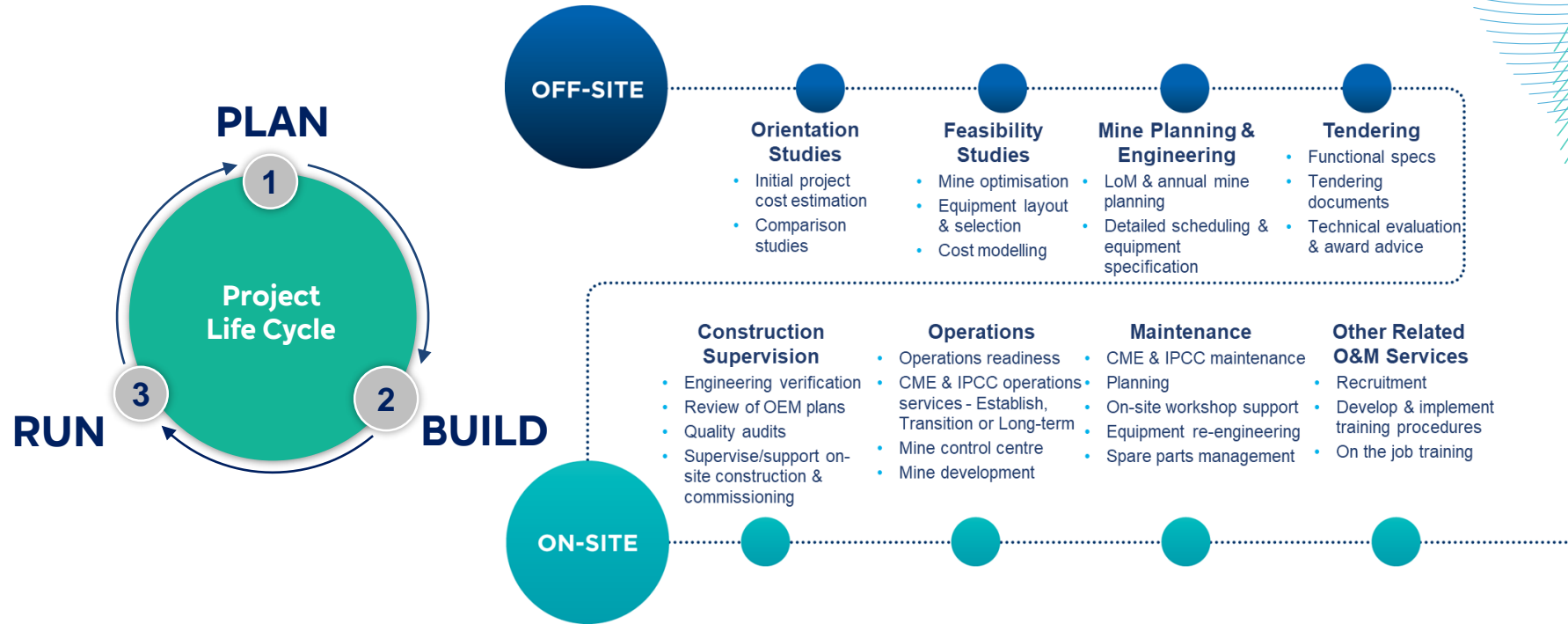
**Logistics**

330 km of own railwaysystem  
47 locomotives

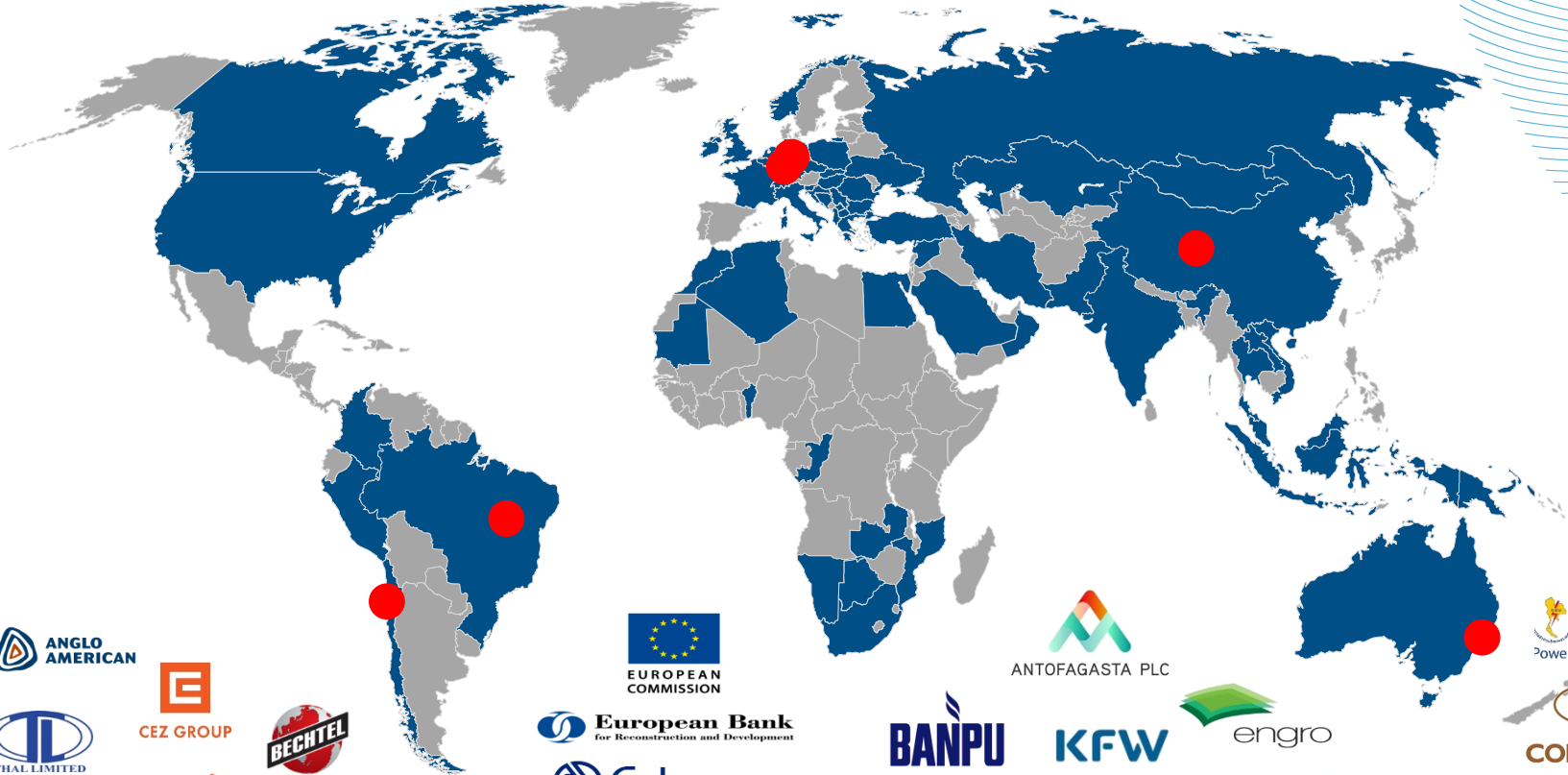
**Dewatering**

1.500 wells  
750 km of pipework  
4 waterworks

# RWE-TI's Services include:



● RWE Office



ANTOFAGASTA PLC



SIEMENS



SAHAKOL



VALE



SEC MC  
Sindh Engro Coal Mining Company

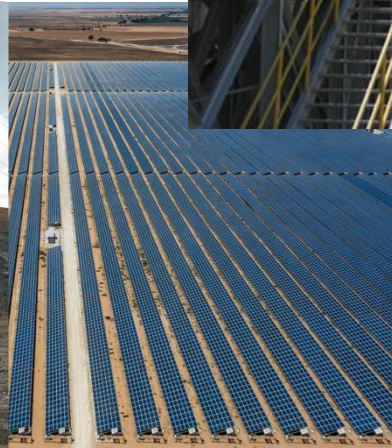




# Typical Examples of our Work



Operational Assistance  
(leverage existing technologies)



Innovative Technologies  
(think out of the box)



Engineering & Tech. Audits  
(optimization of plants)



# RWE Technology International

## 2. Carbon / GHG Reduction by the Utilization of Continuous Mining Equipment



# **Is CME a sustainable GHG emission reducing substitution for conventional Truck/Excavator technology?**

# Key Findings

Electric power continuous mining equipment – incl. IPCC – can substantially and sustainably reduce the GHG emission footprint of an diesel based operation, provided that:

- High mass movement is required
- Vertical transport component (rise) is significant
- Lifetime of operation justifies the corresponding investment
- The source of electric power has a renewable component

## ➤ **Renewable Energy is the Key**

The substitution of diesel powered fleet by electric powered equipment can have further positive side effects such as a

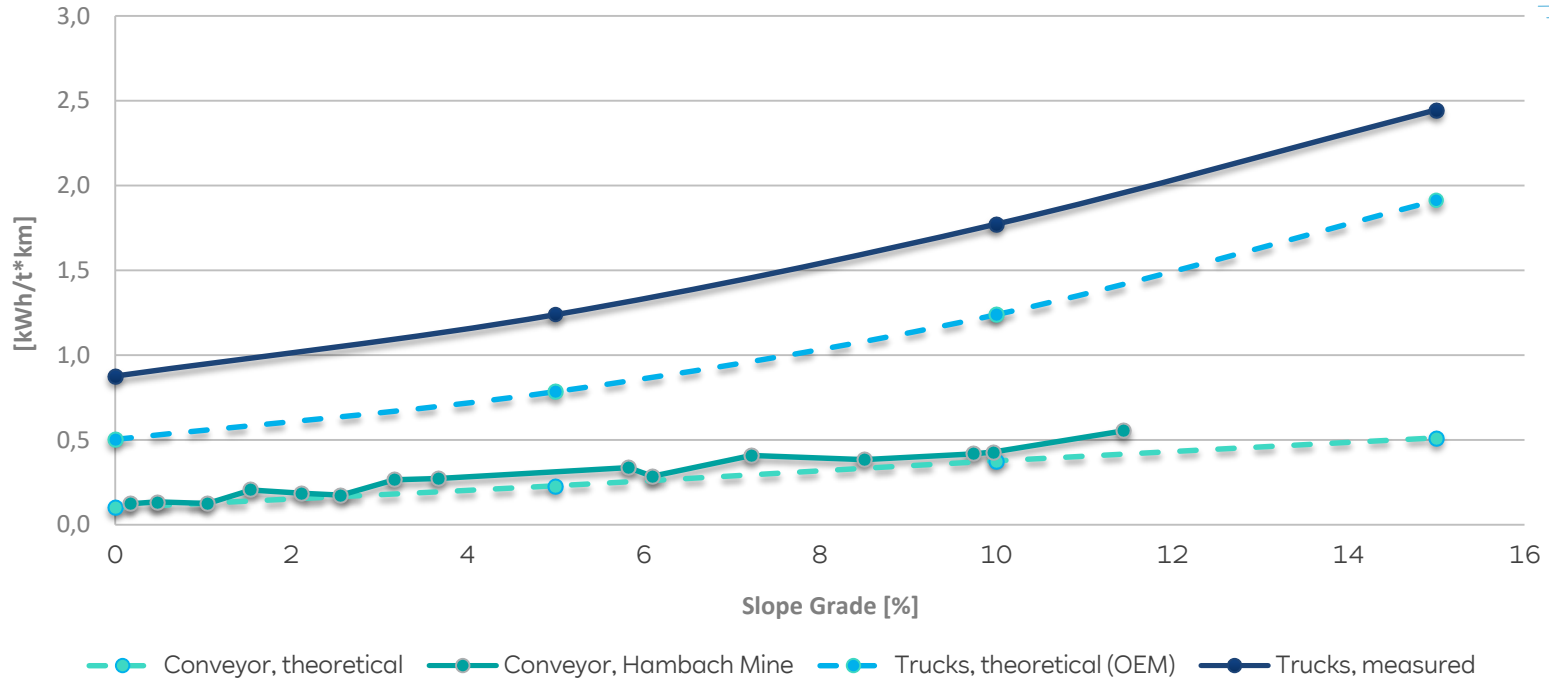
- High degree of automation
- Reduction of dust emissions and water consumption
- Significant reduction in operating costs
- Reduced exposure to (future) carbon taxes

## ➤ **Balancing technological solutions – LCA economics vs CO<sub>2</sub> footprint**

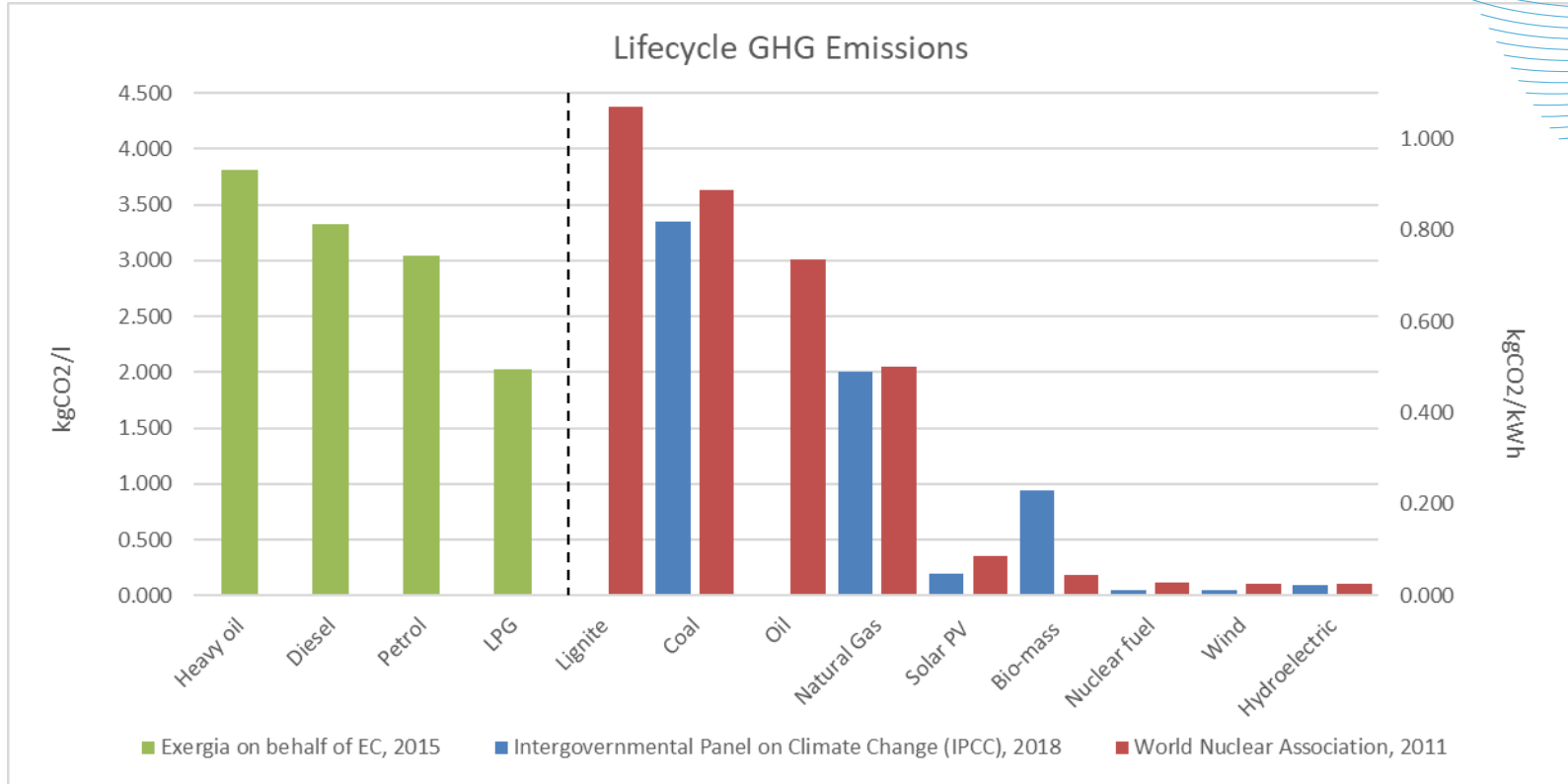


# Energy Consumption of Material Transport Modes

## Comparison of Specific Energy Consumptions of Trucks and Conveyors

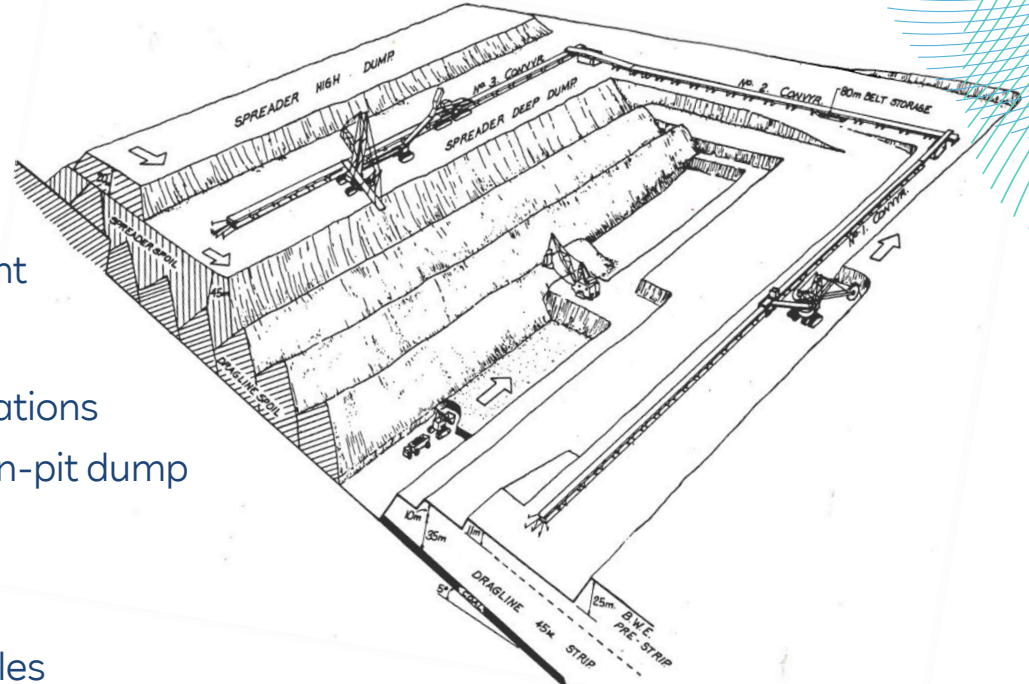


# GHG Footprint Comparison of different Energy Sources



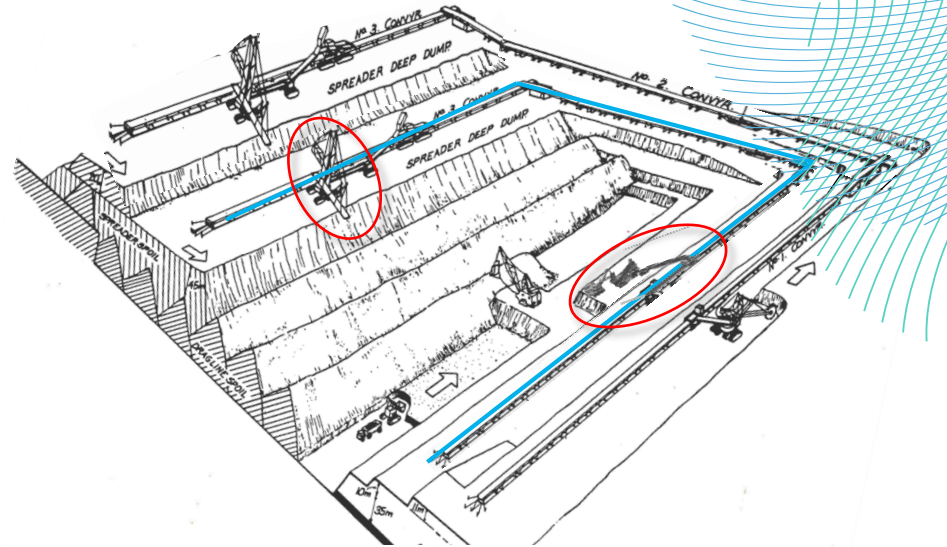
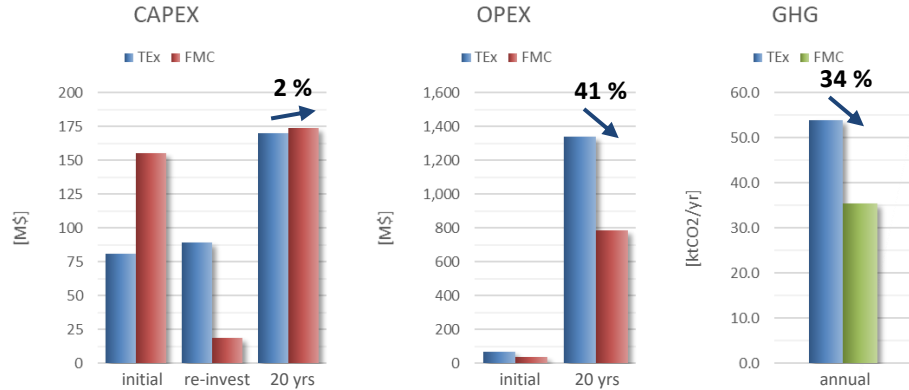
# General Assumptions for GHG Emission Calculations

- Typical strip mine
- Base Case:
  - › 800 t hydraulic excavator
  - › 360 t ultra class truck
  - › corresponding ancillary equipment
- Base Case vs alternate Option:
  - › Bench wise comparison of applications
  - › Overburden: Face – around pit – in-pit dump
  - › Coal: Face – out of pit – ROM pad
- Energy Mix of Power Supply:
  - ›  $\frac{1}{3}$  coal +  $\frac{1}{3}$  gas +  $\frac{1}{3}$  renewables

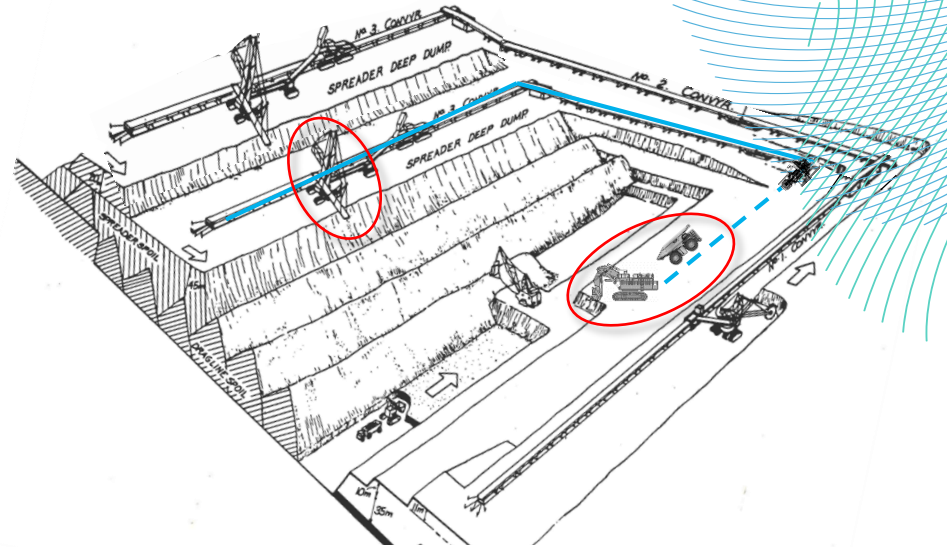
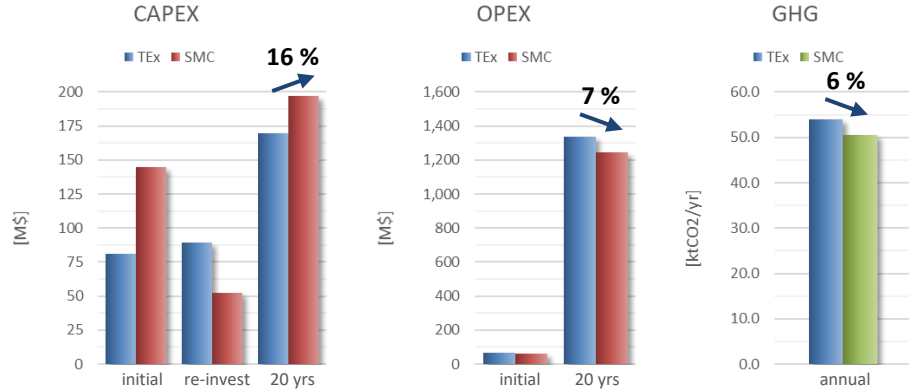




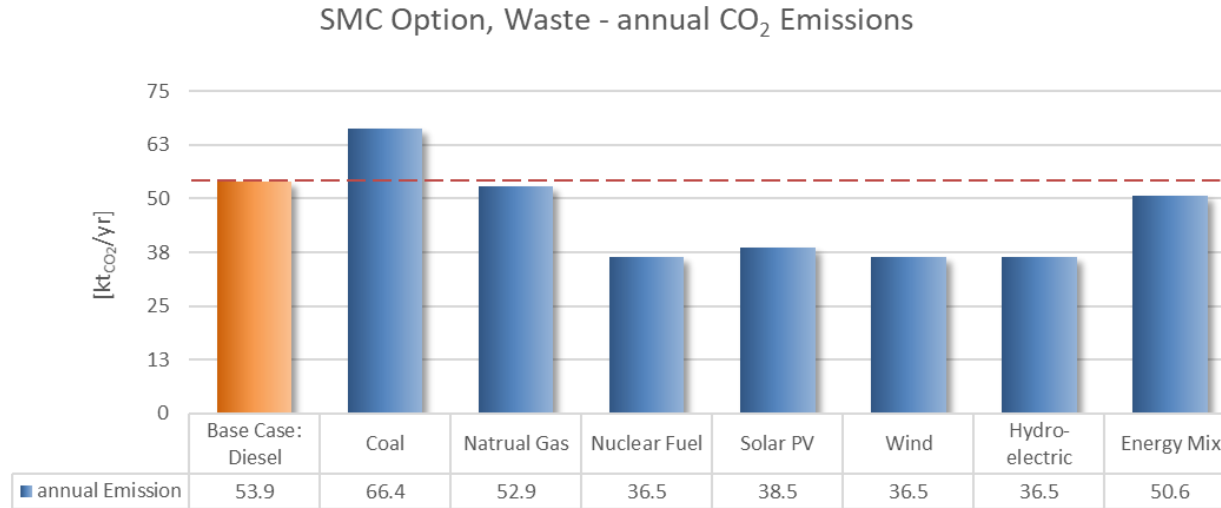
# Waste Option B: TEx vs fully mobile Crushing Unit



# Waste Option C: TEx vs semi-mobile Crushing Unit



# GHG Footprint Comparison of different Energy Sources for the semi-mobile IPCC option





# Results and Limitations of GHG Emission Calculations

- Energy Mix used in model was mainly based on conventional energy sources
  - › contribution of renewables will increase, electric powered equipment will substitute diesel
- Calculations for Strip Mine Bench only
  - › Applications can be modelled for any type of open-pit mine
  - › The more rise is in the haulage profile, the greater is the potential for GHG emission reductions
  - › Steep angle conveying is an application for hard rock mines which is worthwhile to investigate
- Only direct job costs are shown, no indirect and/or ownership costs
- **Carbon taxation costs are not considered !**
- GHG emission reductions can be accompanied by savings in operating expenditures (on cost of initial capital expenditures, which will be more than offset eventually)

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## 3. Summary - Conclusion

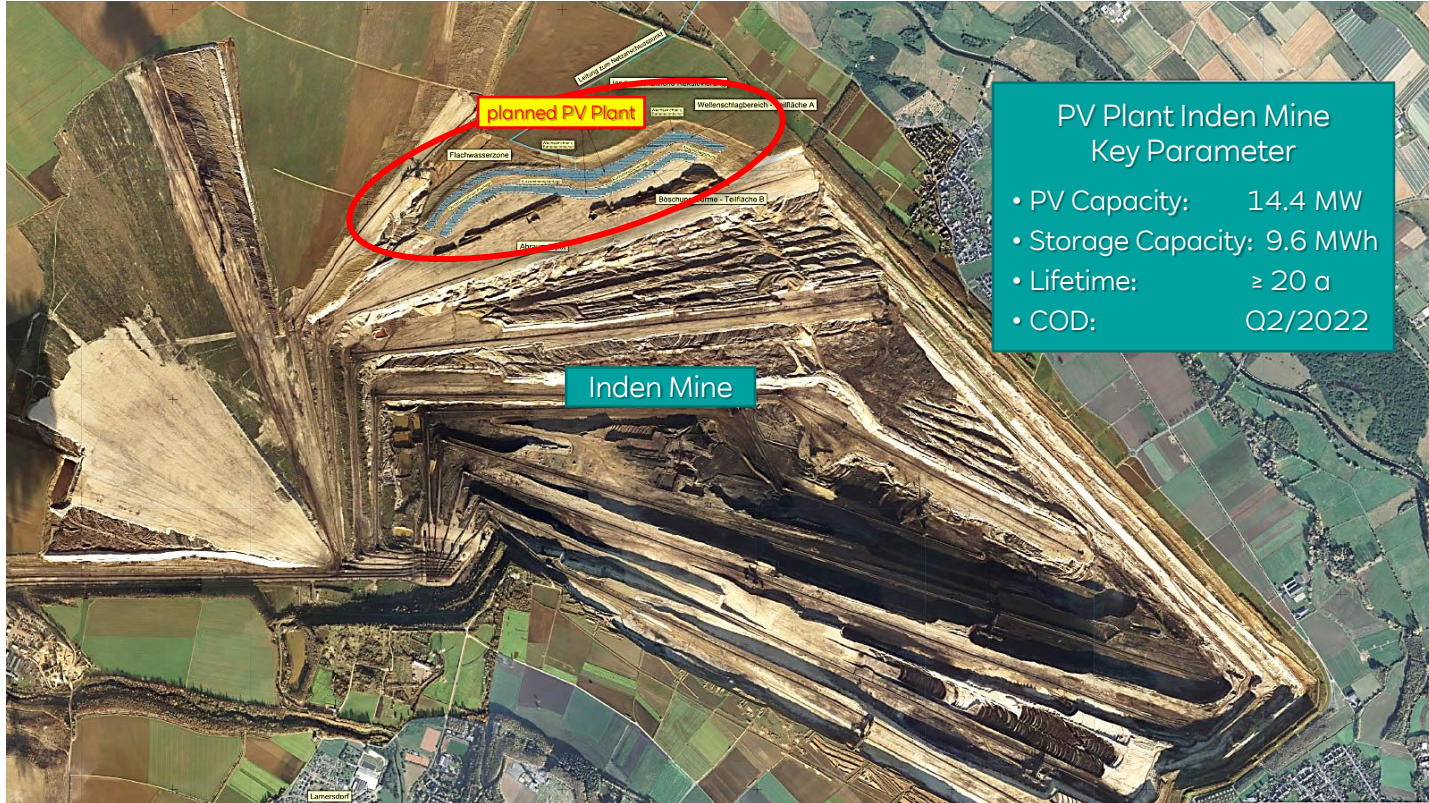


# Summary - Conclusion

- RWE TI is a highly specialized consulting and engineering firm for electric powered Continuous Mining Equipment (CME), including In-pit Crushing and Conveying (IPCC)
- RWE TI fully understands the key factors to reduce your carbon emission in your mine from generation to consumption
- A more sustainable operation through Carbon Footprint reductions can be achieved in any mine operation on any commodity
- RWE TI has innovative solutions to reduce your GHG emissions which can reduce your operational costs at the same time
- The substitution of diesel powered fleet by electric powered equipment can have further positive side effects such as a high degree of automation or reduction of dust emissions and water consumption
- RWE TI is ideally positioned to guide you to the new energy world of tomorrow



# At RWE we realize the integration of renewable power generation at our own operation



# Thank you for your attention!

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