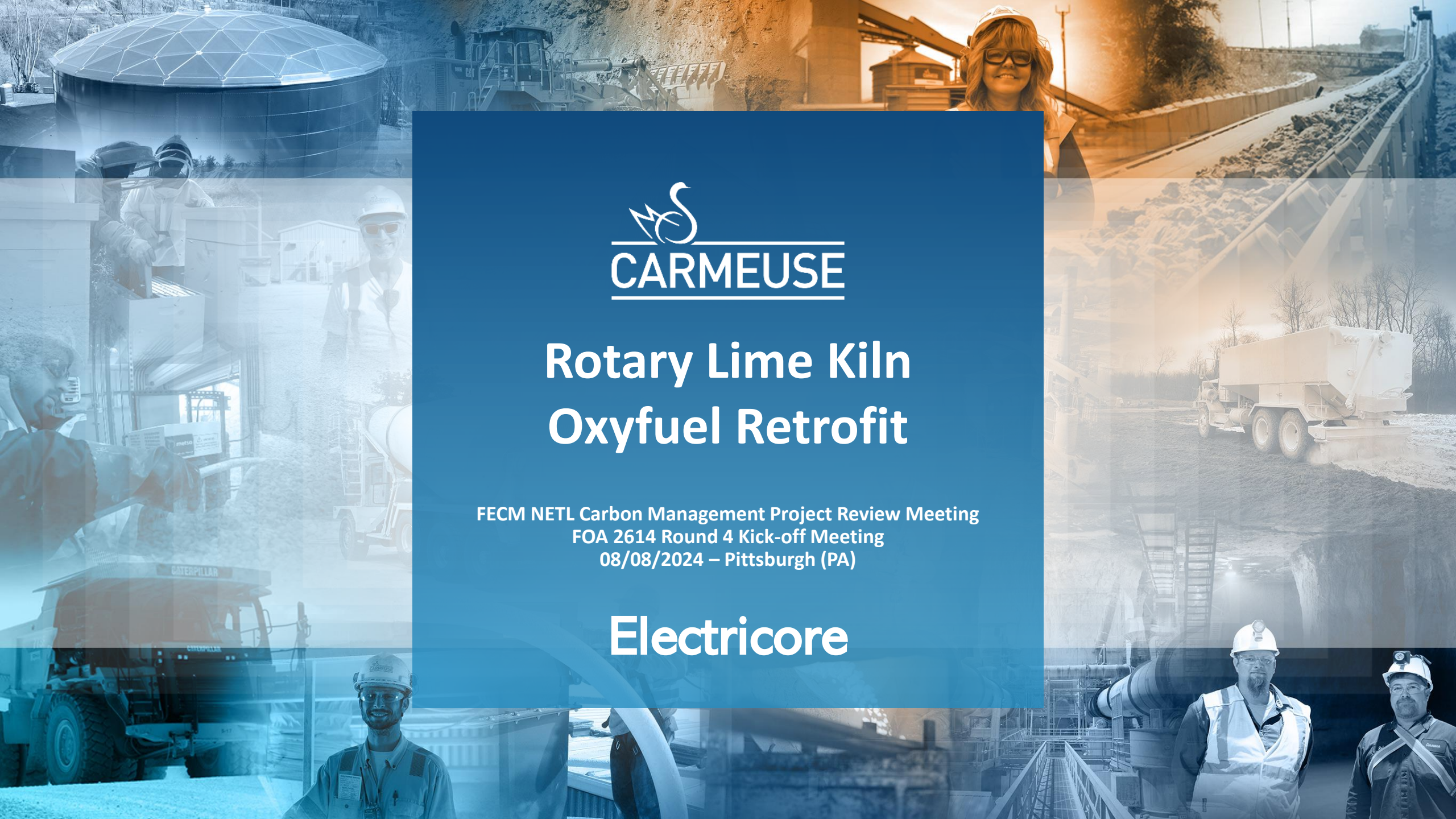


CARMEUSE

Rotary Lime Kiln Oxyfuel Retrofit

FECM NETL Carbon Management Project Review Meeting
FOA 2614 Round 4 Kick-off Meeting
08/08/2024 – Pittsburgh (PA)

Electricore

Project aims to assess feasibility of increasing CO_2 concentration in rotary lime kiln flue gases

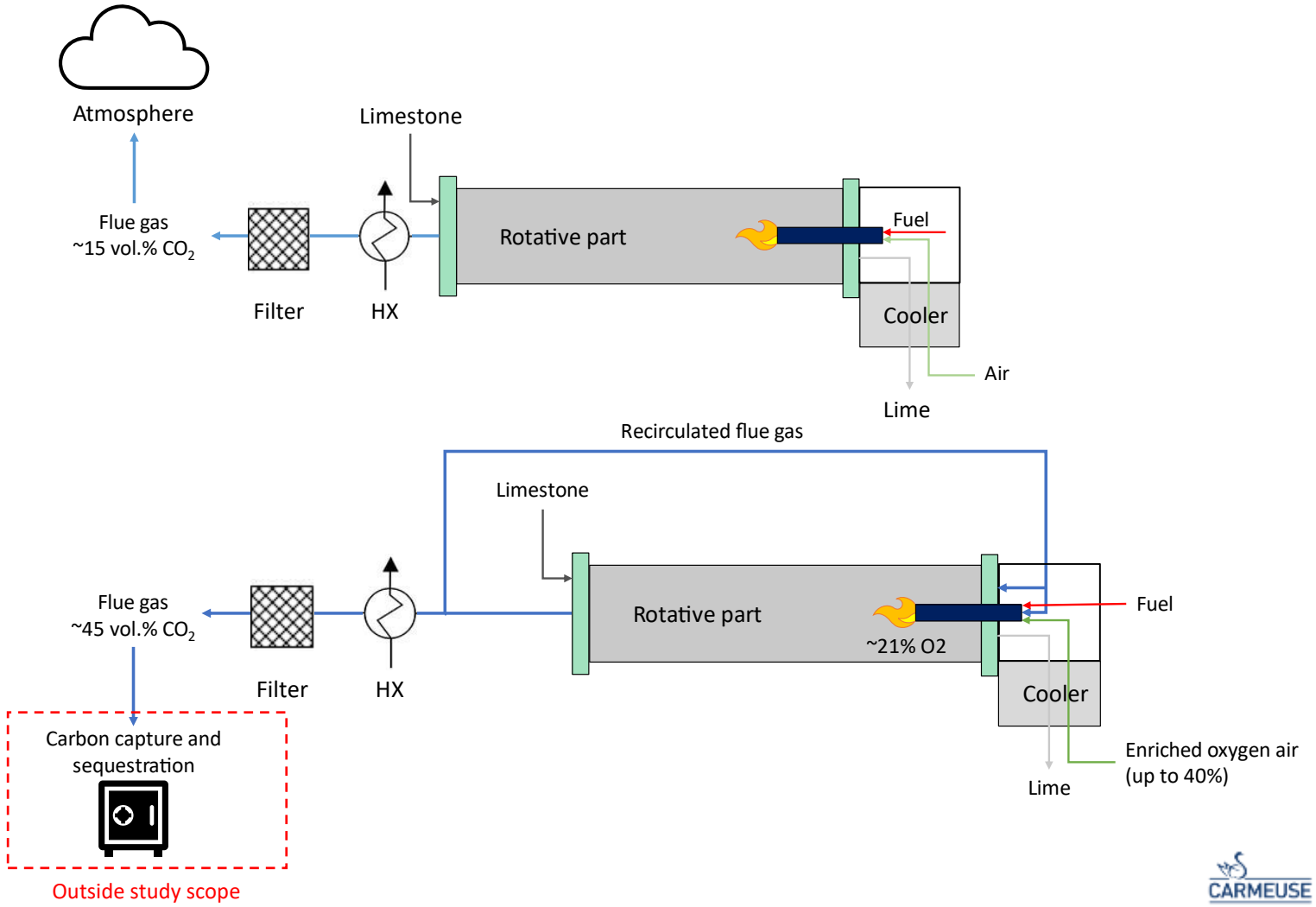
Goal is a concentration of 45% CO2 at the stack through a combination of oxyfuel combustion and flue gas recirculation

Conventional long rotary kiln

- Most common design in US
- High waste heat (>1000 F)
- 15%vol. (dry) CO2 at stack
- Flue gases vented

Partial oxyfuel retrofit

- Partial oxyfuel to reduce air dilution
- Waste heat recovery through FGR
- ~45%vol. (dry) CO2 at stack
- Flue gases sent to carbon capture



electricore

CARMEUSE

Increasing CO_2 concentration reduces downstream carbon capture cost

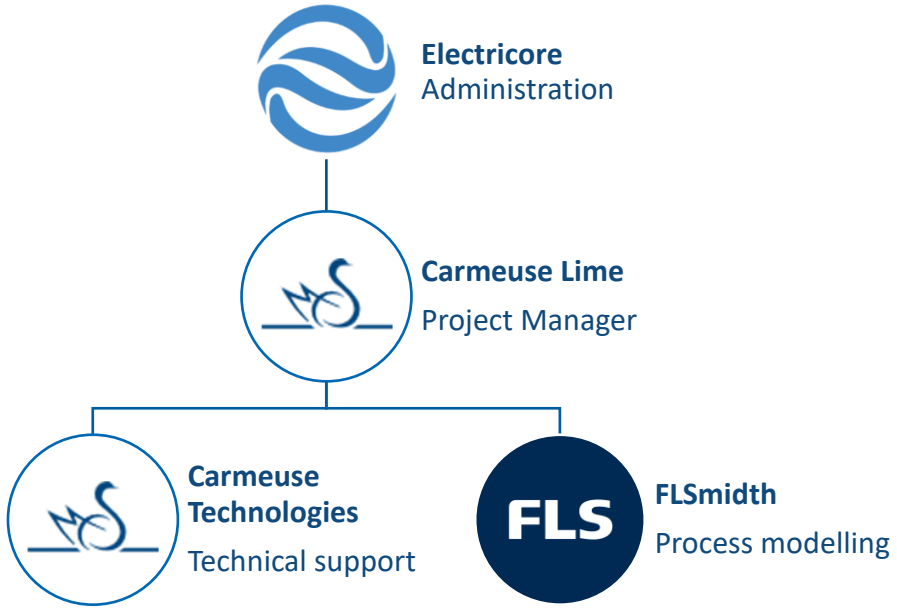
Combination of oxyfuel and FGR increases CO_2 concentration while improving energy efficiency

- Increasing CO_2 concentration reduces carbon capture CAPEX and OPEX
  - Reduced flue gas volumes results in:
    - Reduced flue gas (pre-)treatment equipment size
    - Reduced fan power consumption
    - Reduced carbon capture equipment size
  - Increased CO2 partial pressures results in:
    - Accelerated carbon capture kinetics
    - Reduced carbon capture energy consumption
- Flue gas recirculation to maintain 21% 0_2 at burner
  - Simplifies flame management
  - Partial waste heat recovery increases overall energy efficiency by 15 to 25%
  - Increased energy efficiency reduces required O_2 consumption to reach target CO2%

Carmeuse contracted FlSmidth and Carmeuse Technologies to perform conceptual engineering design

FLSmidth scope includes process modelling and CFD analysis with support from Carmeuse engineering & R&D teams

- Electricore (Prime)
  - Non-profit managing public-private partnership research projects
  - Award administration
  - Budget: $50,000
- Carmeuse Lime (Sub-recipient)
  - World leader in lime production, operating 13 lime production sites in the USA
  - Project management, data collection, capital cost estimates, preliminary TEA, LCA and EH&S analysis
  - Budget: $62,500
- Carmeuse Technologies (Vendor)
  - Engineering / R&D branch of the Carmeuse group (based in Belgium)
  - Technical support and advice to the engineering study
  - Budget: $28,000
- FLSmidth (Vendor)
  - Leading equipment and engineering supplier for the mineral processing industry
  - Generate process models using METSIM software, CFD analysis of FGR mixing and support equipment selection and budget estimations
  - Budget: $172,000



Task	Description	A-24	S-24	O-24	N-24	D-24	J-25	F-25	M-25	A-25	M-25	J-25	J-25
1.1	PMP	■											
1.2	TMP	■	■	■									
1.3	CBP	■	■	■	■	■	■	■	■	■	■	■	■
2.1	Project scope	■											
2.2	Conceptual design	■	■	■	■	■	■	■	■	■	■	■	■
2.3	OBDI											■	
2.4	Preliminary TEA										■	■	
2.5	Preliminary LCA							■	■	■			
2.6	EH&S							■	■	■			
2.7	TGA										■	■	
3.0	Phase 2 application										■	■	■

electricore

METSIM

CARMEUSE

Acknowledgement
This material is based upon work supported by the Department of Energy under Award Number DE-FE0032504.

CARMEUSE

IMPACTING EVERYDAY LIFE