# Electric Boiler Workshop

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Sustainable action for a better tomorrow



#### Jonathan Pooch

Managing Director





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### Hosting today's Workshop

# NZ Energy Emissions



NZ emissions based on:

https://emissionstracker.mfe.govt.nz/#NrAMBoEYF12TwCIDiAnA9gZ042wBM4+okALHgBxK7RA https://www.eeca.govt.nz/assets/Resources-EECA/EEUDB\_Summary\_2017.xlsx



### What is the opportunity?

### Cost of delivered heat?



#### **Electric Boilers - Technical Introduction**

- Working principle electrical energy to heat
- Energy input and conversion
  - Power supply requirements
  - Conversion efficiency
- Performance characteristics
  - Pressure and temperature range
  - Heating capacity
  - Ramp-up time and controllability
  - Peak load and its management
  - Response time and turndown ratio
- Types of electric boilers
  - Resistive type
  - Electrode type
- Key components pressure vessel, elements/electrodes, pumps,...
- Control systems and integration
  - Temperature and pressure control
  - SCADA/BMS integration
  - Remote monitoring and automation capability



Heating via resistive elements



Heating via electrodes & conductive water



#### **Electric Boilers - Technical Introduction**

- Water treatment requirements
  - Hardness removal, dissolved oxygen control, TDS control, PH, corrosion inhibition...
  - Conductivity control (very important for electrode boilers)
- Suitable applications and industries
  - Low to medium temperature process heat (100°C 250°C)
  - Backup and peak load boilers
  - Transition away from fossil fuels
- Feasibility considerations
  - Pre-work requirements (thermal metering, understanding demand profile, how is thermal energy used and where)
  - Efficiency first what are the things that can be done first
  - What type of technology fits my site electrode vs electric, HW vs steam
  - Potential of hybrid systems improved redundancy and beyond
  - Financial analysis
  - Capture limitations

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**Thermal Meter** 



### Case Study - Mataura Valley Milk

- 20MW electrode high pressure (40bar<sub>q</sub>) boiler
  - Completely removes the need for the existing coal boiler
  - First high pressure electrode boiler in New Zealand
- Key enablers:
  - Motivated client (and shareholder)
  - Market pressure from customers wanted to differentiate away from commodity based products
  - Long term, low cost electricity deal from energy retailer
  - GIDI Funding
- Key challenges:
  - Electrical network connection
  - New technology deployment
  - Ownership change followed by subsequent change in key customer base
  - Integration within existing plant
  - Live commissioning









#### Jonathan Pooch

Managing Director





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### LUMEN

### Workshop Discussion and Structure

#### Group Exercise / Breakout Discussion

- For an industrial site with two diesel fired steam boiler systems (1.2MW each ) with the following characteristics
  - Peak demand measured at 1.4MW with 95% of the loads below 1MW over 12 months
  - 20 % of the energy goes to domestic hot water and washdown water heating to 65°C
  - The rest is used for processing at 150°C or more
  - Operates 24/7
- Group discussion on where and how an electric boiler would fit in this situation?



WORKSHOP QUESTION: Capex Management

#### Capex Management

#### Key considerations:

- Pre-design and system design
- Project management
- Electrical infrastructure upgrade
  - Transformer/s and electrical metering
  - HV and LV cabling
  - Main switchboards
  - Electrical for mechanical requirements
- Civil and structural works (building works, ground testing, foundation work, trenching, ...)

a better tomorrow

- Equipment (boiler systems) supply and install
  - Integration and piping
  - Thermal metering
  - Water treatment
  - Drainage
- Controls and automation
- Compliance, health and safety
- Testing and commissioning
- As built drawings
- Training and sign off



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WORKSHOP QUESTION: Opex Management

### **Opex Management**

#### Key considerations

- Use less energy!
  - Efficiency first
  - Managing site loads to smooth load profile
  - Using the right temperature/pressure for the correct load
  - Storage of thermal energy as appropriate
  - Smart energy management
- Energy supply contracts
  - Long term deals
  - PPA arrangements
  - Spot market exposure
- Demand side participation
  - Fast Instantaneous Reserves (<6s, last for 1min)
  - Slow Instantaneous Reserves (~60s, last for 15mins)
  - EDB demand management
  - Transpower demand management
  - Energy retailer demand management
- Onsite electricity generation

CONTRACT Spot price Electricity price **Trigger price** Time of the day



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#### WORKSHOP - KEY TAKEAWAYS

# Key Takeaways

- Electric boilers support decarbonisation goals for NZ's process heat
- Efficiency first is important for optimisation
- Electric boilers are best suited for low to medium temperature applications (<250°C); high-temp use may be limited
- Electrical upgrades may limit feasibility early engagement with lines companies is essential
- Electricity is efficient but can be expensive special tariffs, off-peak pricing and flexibility/redundancy may improve economics
- Thermal storage enables load shifting and grid-friendly operation
- Electric boiler projects require careful planning, design, and implementation to ensure technical and economic viability.

