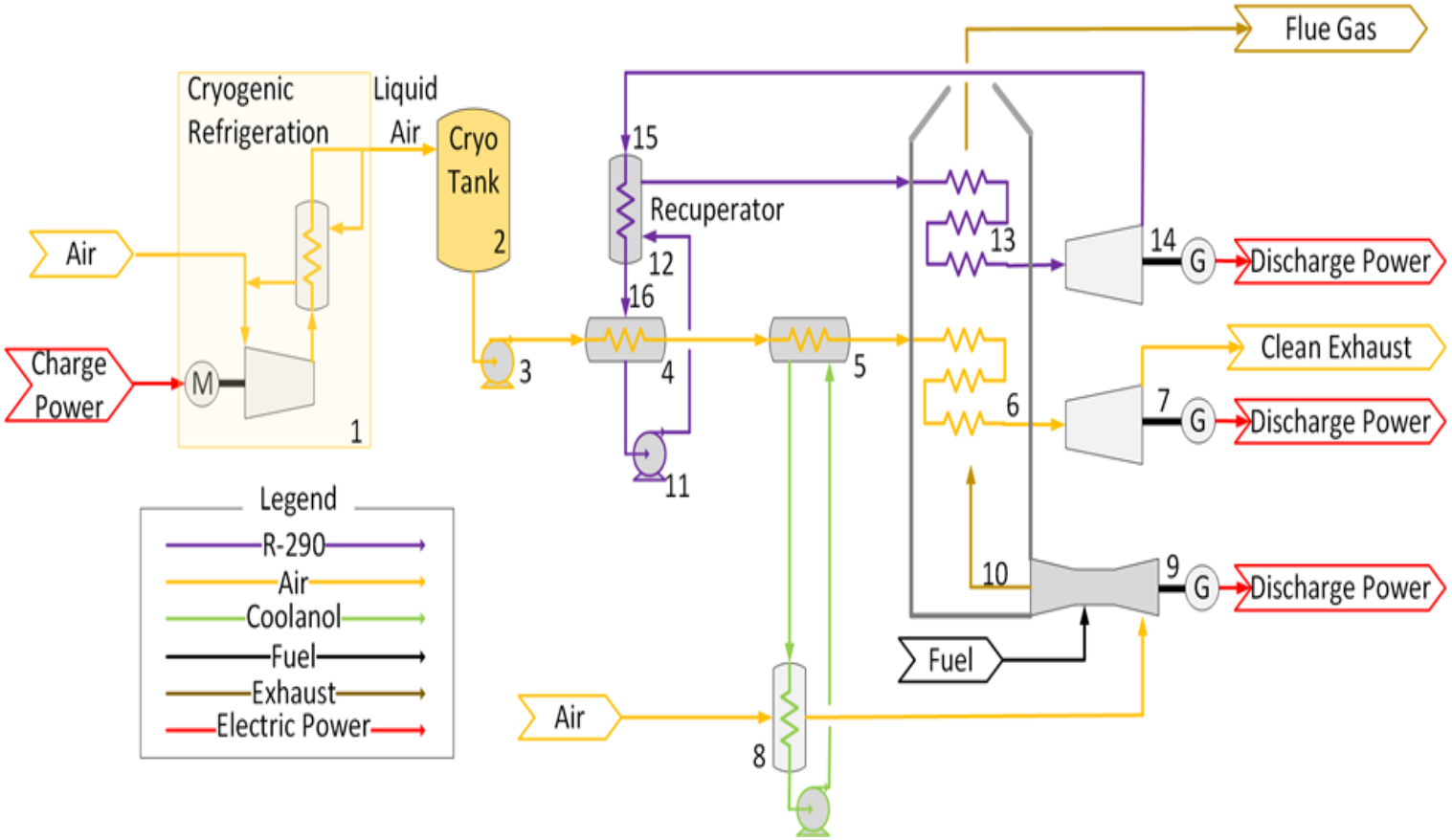
Liquid Air Combined Cycle (LACC) for Power and Storage

Thermal-Mechanical-Chemical Energy Storage (TMCES) Workshop
10-11 Aug 2021



U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY

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SwRI

Southwest Research Institute
San Antonio, TX

PI: Mr. Aaron Rimpel
Dr. Owen Pryor
Dr. Aaron McClung
Dr. Tim Allison

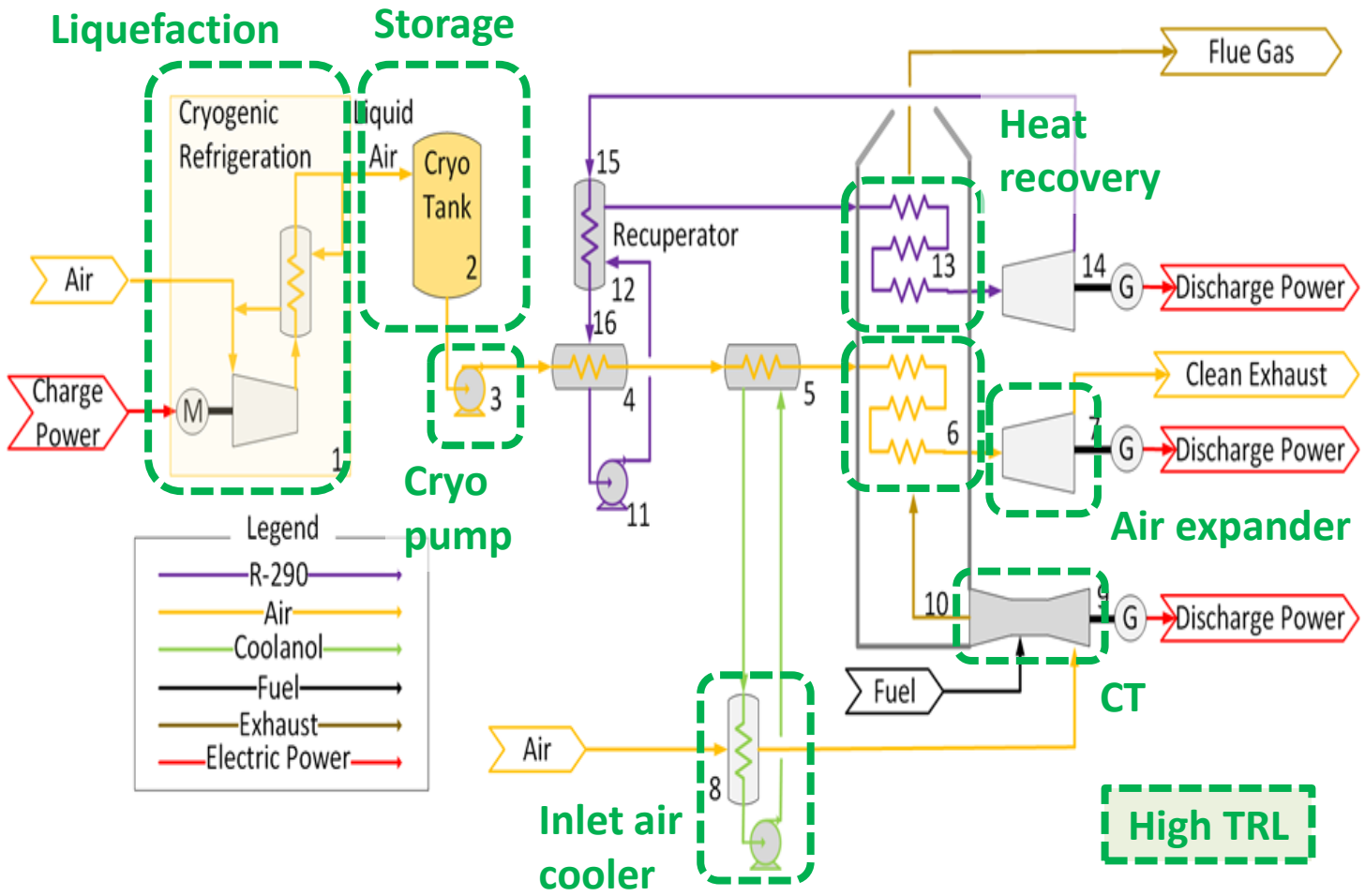
PINTAIL POWER

Pintail Power LLC
Palo Alto, CA

Co-PI: Dr. Bill Conlon
Mr. Milton Venetos

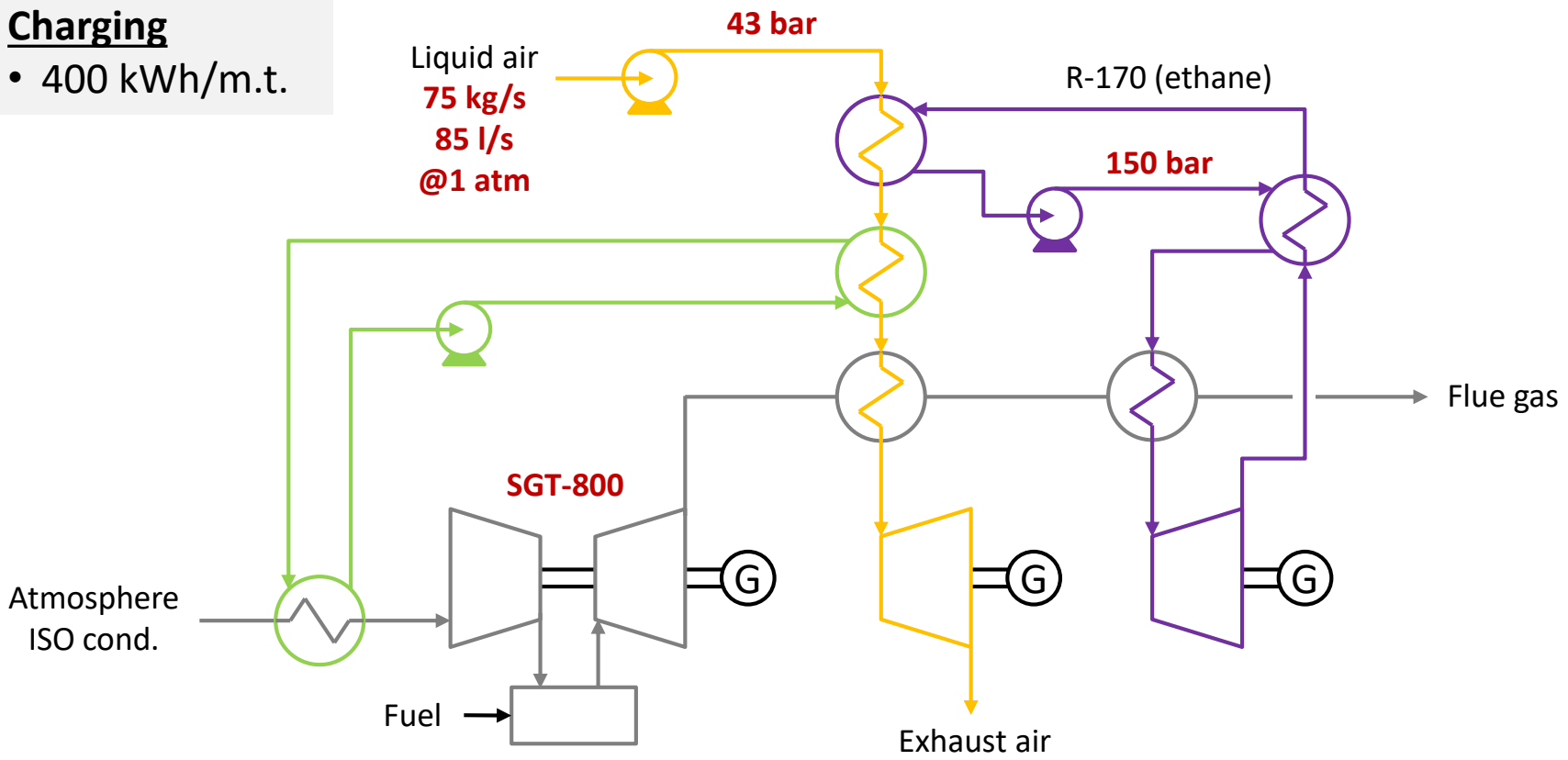
LACC can be applied to existing or new combustion turbine assets

- Advantages
  - Any CT
  - Site anywhere
  - High-TRL components
  - Valuable at large scale
  - Lower CAPEX
- DOE project objectives
  - Identify application
  - LACC conceptual design
  - Demo-scale LACC



Feasibility calculations have demonstrated preliminary performance

Charging
- 400 kWh/m.t.



Discharging

- Net power
  - SC: 54 MW
  - CC: 77 MW
  - **LACC: 104 MW**
- Fuel heat rate
  - SC: 8,725 Btu/kWh
  - CC: 5,993 Btu/kWh
  - **LACC: 4,532 Btu/kWh**
- Primary (electric) energy rate

$$\frac{\text{Charge energy}}{\text{Discharge energy}} = \mathbf{1.04}$$

- Liquid air rate = **2.6 kg/kWh**

Commercialization/market considerations

- Cryo liquefaction is capital intensive
  - Reducing liquid air consumption key cost reducer
  - Zero-cost storage medium offsets CAPEX
  - Benefits from economy of scale

- Coupling opportunities
  - Fuel security (co-liquefy natural gas)
  - H_2, Renewable fuel cost savings via low heat rate
  - Oxy combustion for carbon capture

Acknowledgement and disclaimer

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Questions?

Aaron Rimpel
aaron.rimpel@swri.org

William Conlon
bill.conlon@pintailpower.com