



ICAES



Disruptive mechanical grid-scale energy storage solution

- Fuel-free mechanical system using compressed air
- None of the cost, life, and safety issues of batteries
- Enables site-flexible and scalable bulk storage
- Lowest levelized cost of energy



Strong Technical & Financial Foundation

Technology



SustainX Founded
(Dartmouth spin-out)

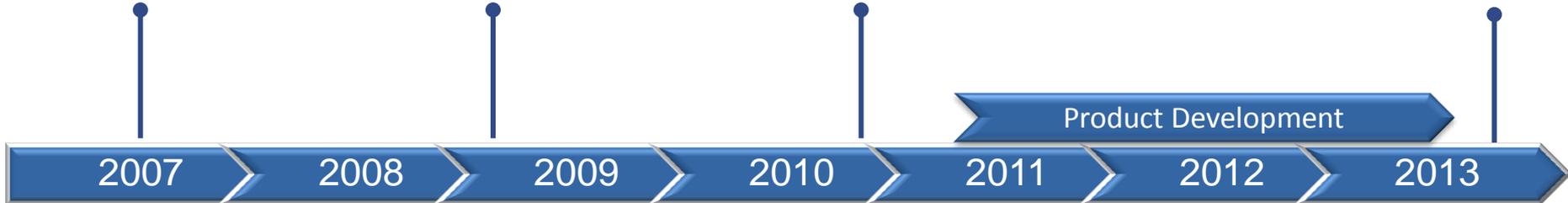
1kW – 5kWh
Alpha System



40kW Pilot



1.5 MW Full-Scale Prototype



High-Quality Strategic Investors



General Catalyst
Partners



ANGELI PARVI



Financing

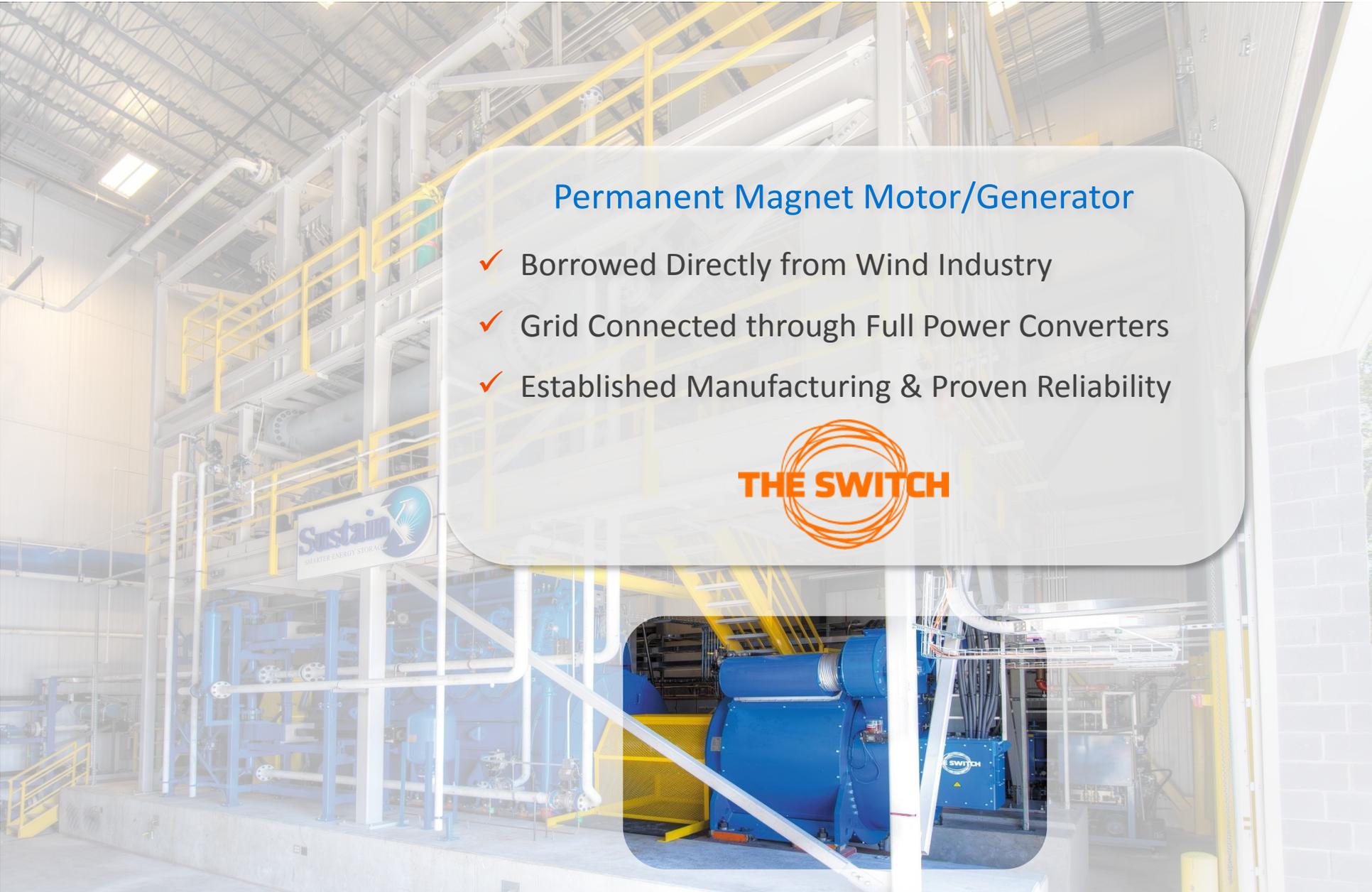
Commercial Performance Validated on 1.5 MW ICAES System



- ✓ System Power
- ✓ AC Roundtrip Efficiency
- ✓ Foam Heat Transfer
- ✓ Valve Performance
- ✓ Valve Reliability (1M+ cycles)
- ✓ Storage Pressure
- ✓ Mature Driveline

Permanent Magnet Motor/Generator

- ✓ Borrowed Directly from Wind Industry
- ✓ Grid Connected through Full Power Converters
- ✓ Established Manufacturing & Proven Reliability



Crankshaft

- ✓ Borrowed Directly from Diesel Industry
- ✓ Drives Reciprocating Pneumatic Process
- ✓ Established Manufacturing & Proven Reliability





Heat Transfer Technology

- ✓ Patented Foam-Based Isothermal Process
- ✓ $>200 \text{ Bar } \Delta \leftrightarrow <50 \text{ }^\circ\text{C } \Delta$
- ✓ Mature Industrial Components and Principles

Commercial Performance Validated on 1.5 MW ICAES System



Driveline Speed (RPM) **99** Grid Power (kW) **-1601** LPMAN [PSIA] **15.3** MPV [PSIA] **214** HPMAN [PSIA] **2094** Storage [PSIA] **2088** State of Charge

Convert Tool: PSI to BAR **EXIT**

CALIBRATIONS DIAGNOSTICS PROBES

Experiment: ELC CRK LOS DRV ECS HPU MAN SRV PAUX LPPMP LPMAN LPC-520 LPC-530 LPC-540 LPC MPV HPC-560 HPC-570 HPC-580 HPC HPMAN STG STGAUX Logging HDR INFO HPU_C FLUSH

SRV LPPMP

m³ VOLUME

°C TANK

BOOST PRESSURE

BARa

STBY

HPC-560 0°

HPC-580 0°

HPC-570 0°

LPC-530 0°

LPC-520 0°

LPC-540 0°

STG STGAUX

m³ VOLUME

°C TANK

AIR

LIQUID

STORAGE PRESSURE

BARa

STBY

POWER UNIT

ISOLATION

RECIRCULATION

POWER BUILDING

°C INSIDE

°C OUTSIDE

LPMAN

°C INTAKE

°C EXHAUST

% EXHAUST

FOAM QUALITY

● CMP RDY

● EXP RDY

MPV

°C MPV

MPV PRESSURE

BARa

% HPC LEG

% LPC LEG

FOAM QUALITY

● CMP RDY

● EXP RDY

HPMAN

°C HPMAN

HPMAN PRESSURE

BARa

% HPMAN

FOAM QUALITY

● CMP RDY

● EXP RDY

LOS CRK

L VOLUME

°C TANK

°C CRANK

LUBE PRESSURE

BARa

STBY

CRK FLOW

ECS DRV

L VOLUME

°C TANK

°C RETURN

COOLING PRESSURE

BARa

STBY

FLOW

DRIVELINE RPM

RPM

HPU MAN

L VOLUME

°C TANK

°C RETURN

SUPPLY

BARa

STBY

BALANCE

BARa

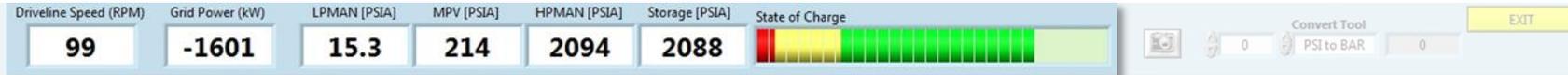
HPC V1

HPC V2

LPC V3

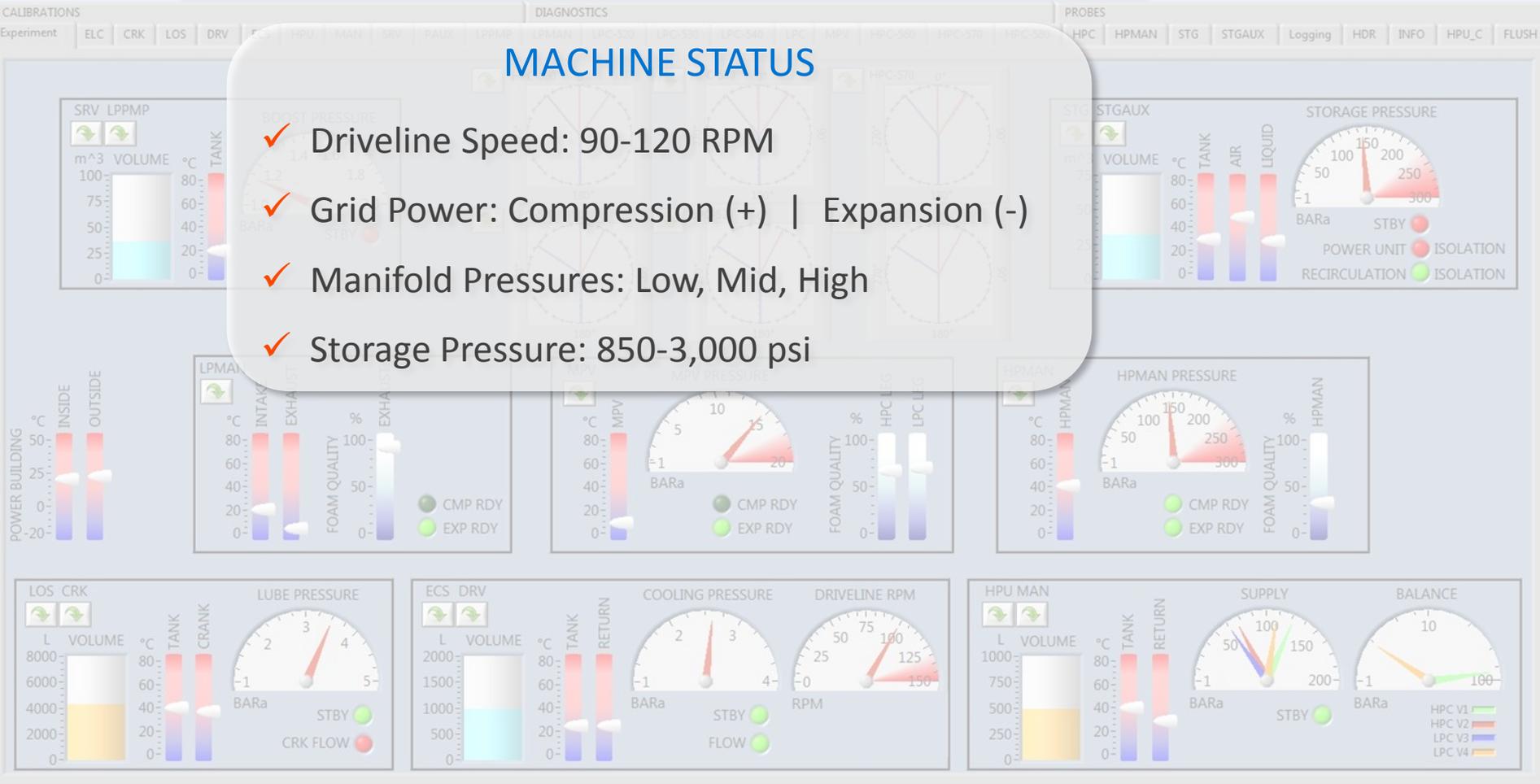
LPC V4

Commercial Performance Validated on 1.5 MW ICAES System

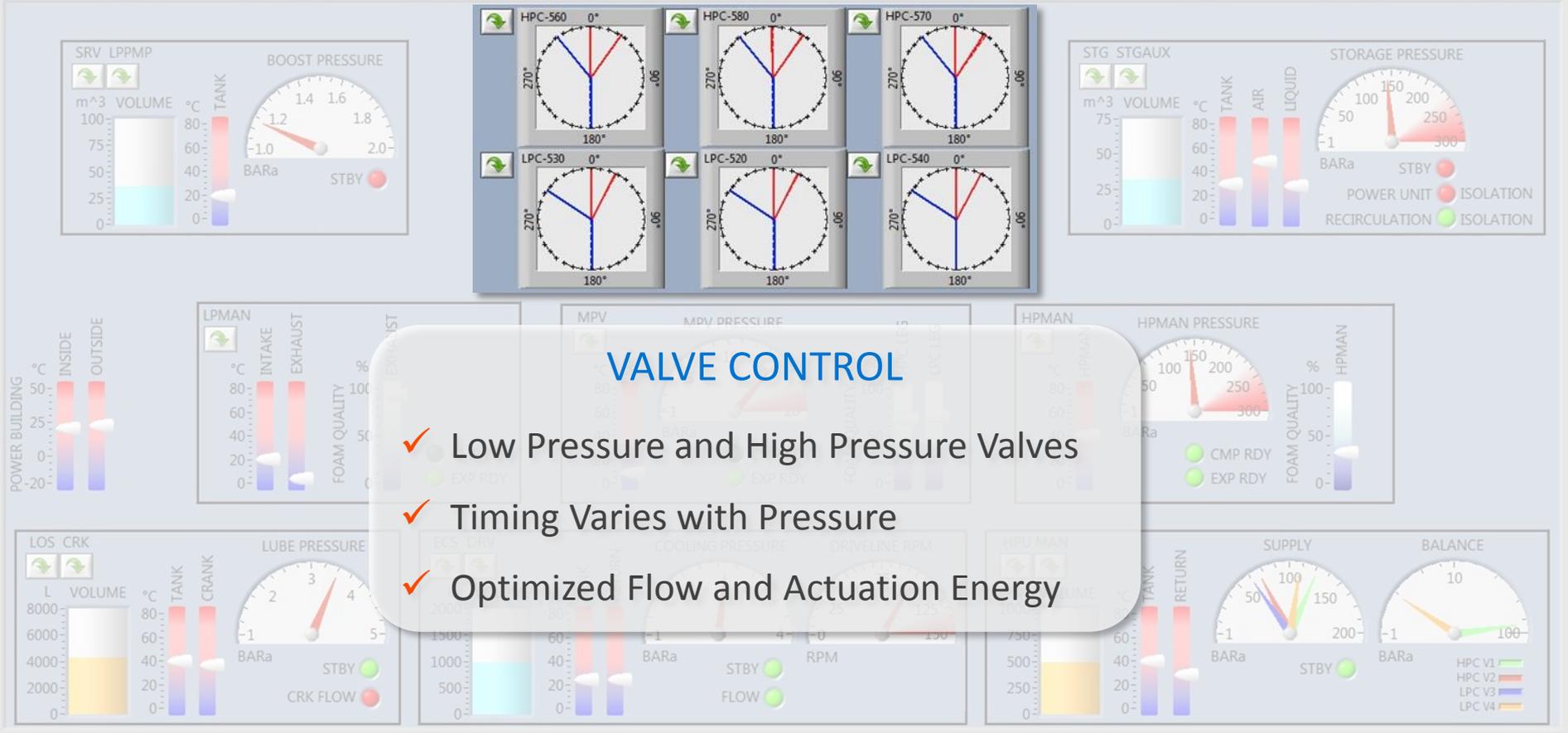
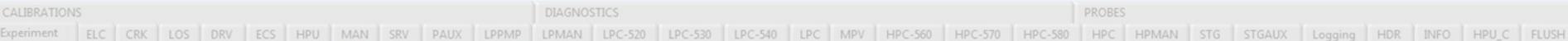


MACHINE STATUS

- ✓ Driveline Speed: 90-120 RPM
- ✓ Grid Power: Compression (+) | Expansion (-)
- ✓ Manifold Pressures: Low, Mid, High
- ✓ Storage Pressure: 850-3,000 psi



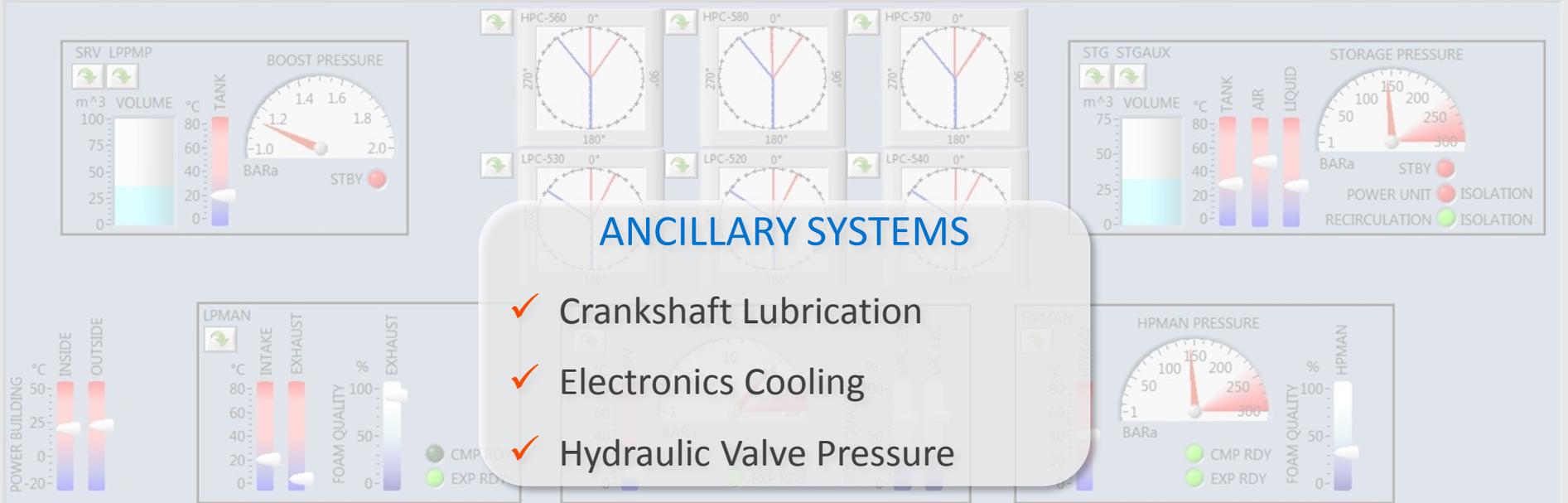
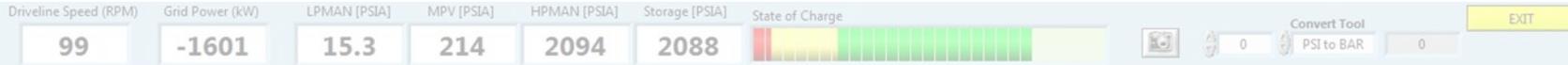
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VALVE CONTROL

- ✓ Low Pressure and High Pressure Valves
- ✓ Timing Varies with Pressure
- ✓ Optimized Flow and Actuation Energy

Commercial Performance Validated on 1.5 MW ICAES System





ICAES 6-CYLINDER

MAN S35 crankshaft



Scalable Crankshaft Platform

- Crankshafts manufactured in many sizes & cylinder counts
- ICAES models with stock S35 Crankshaft start around 2 MW
- Larger bore sizes deliver 5-16 MW per machine (6-cyl)
- Custom designs can reach 30+ MW