Smart Manufacturing and the
Clean Energy Smart Manufacturing Innovation Institute™ (CESMII)

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Overview

- What is CESMII and what is our mission?

- What is the CESMII value proposition?

- What is the Smart Manufacturing Platform™ and how can it be employed?
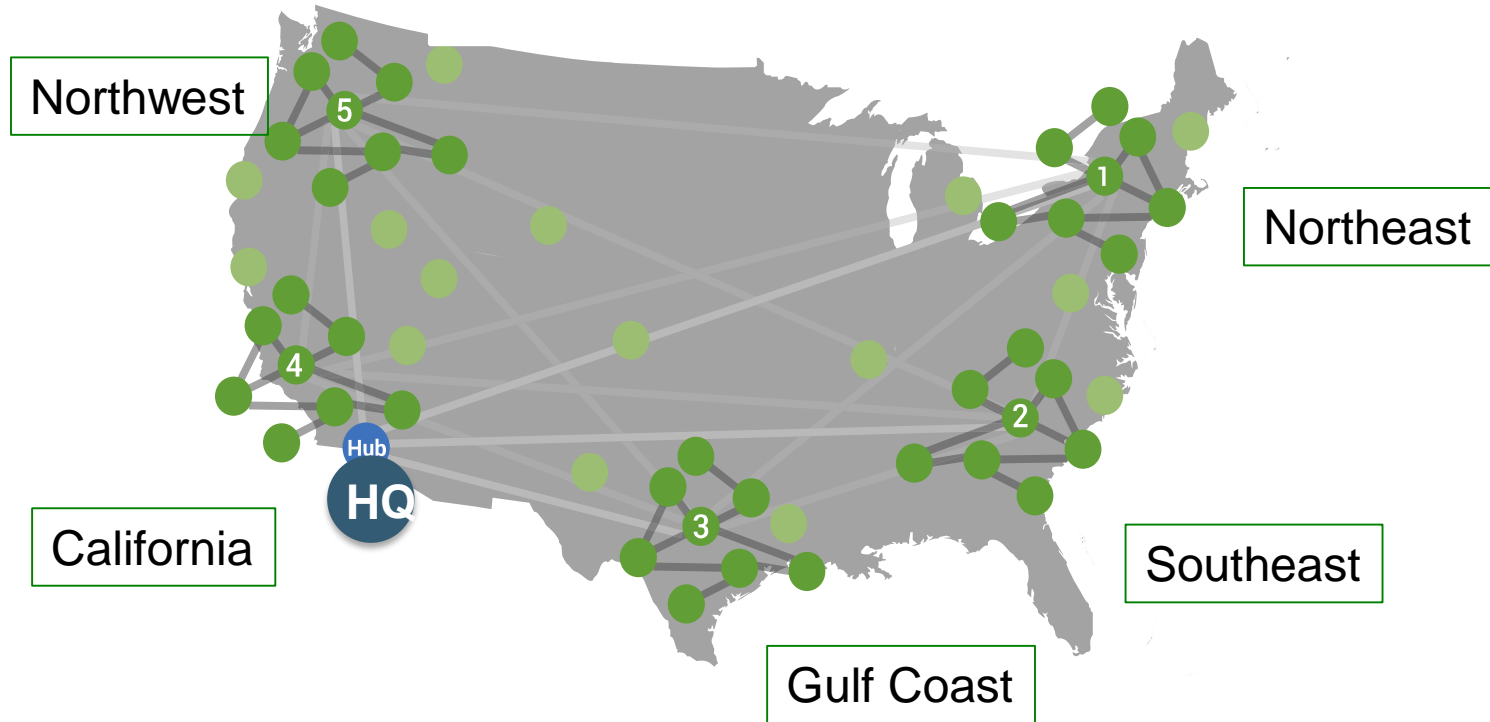
What Is CESMII's Mission?

- The Clean Energy Smart Manufacturing Innovation Institute (CESMII) was created to increase the productivity and competitiveness of US manufacturing companies through improved data insight and by use of advanced analytics.

- CESMII is partially funded by the US Department of Energy (DOE).

- The Smart Manufacturing (SM) Platform™ is cloud based, with best-of-breed analytics, data visualization, and modeling.

CESMII
A National Network of Capability Networks

Northwest

Northeast

California

Southeast

Gulf Coast

The Smart Manufacturing Platform™

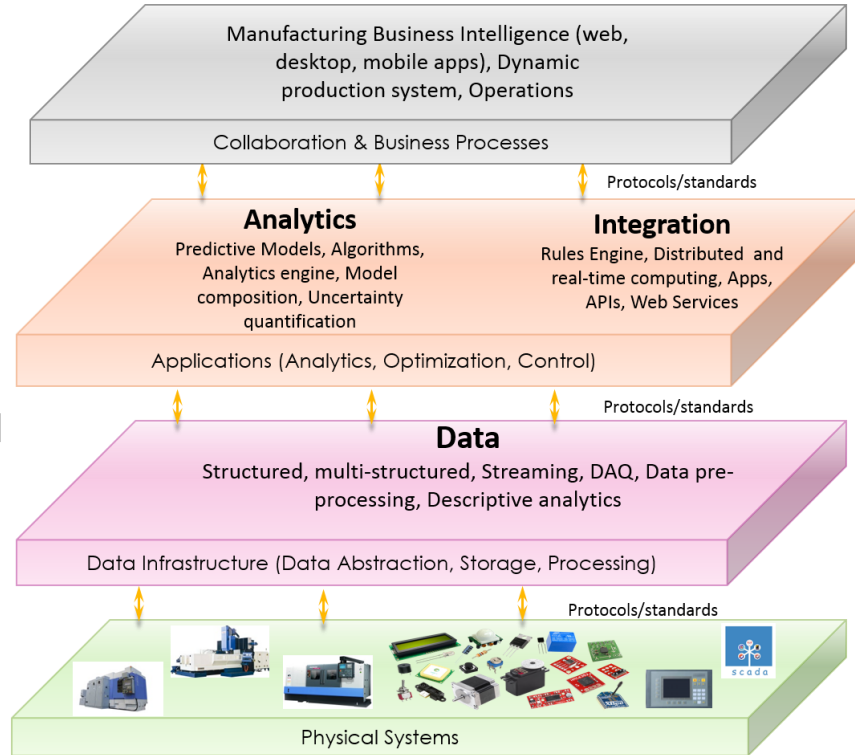# What Is the CESMII SM Platform™ Value for Industry?

- **Monetization of Manufacturing Data: Creation of the "Connected Enterprise"**
  - Leverage connectivity: IIOT enabled systems
  - Move from "Run-to-Failure" to "Reliability-Centered" operations through application of analytics
  - Business/Financial/Energy Optimization at the Enterprise: **"Layers of analytics"**
    - Process level analytics
    - Plant level analytics
    - Supply chain analytics
    - Enterprise level analytics

- **Take advantage of existing/legacy investment**

- **Provide analytics capabilities without needing subject matter experts to maintain or retrain models and analytics**

Smart Manufacturing Layers

- **Industry Testbeds**

- **First-of-Kind Application Toolkits for SM Deployment**

- **Advanced High Fidelity Modeling**

- **Open Standards Software and Communication Platforms**

- **Real-Time Data Analytics and Control Systems**

- **Advanced Sensors**

Manufacturing Business Intelligence (web, desktop, mobile apps), Dynamic production system, Operations

Collaboration & Business Processes

Protocols/standards

Analytics
Predictive Models, Algorithms, Analytics engine, Model composition, Uncertainty quantification

Integration
Rules Engine, Distributed and real-time computing, Apps, APIs, Web Services

Applications (Analytics, Optimization, Control)

Protocols/standards

Data
Structured, multi-structured, Streaming, DAQ, Data pre-processing, Descriptive analytics

Data Infrastructure (Data Abstraction, Storage, Processing)

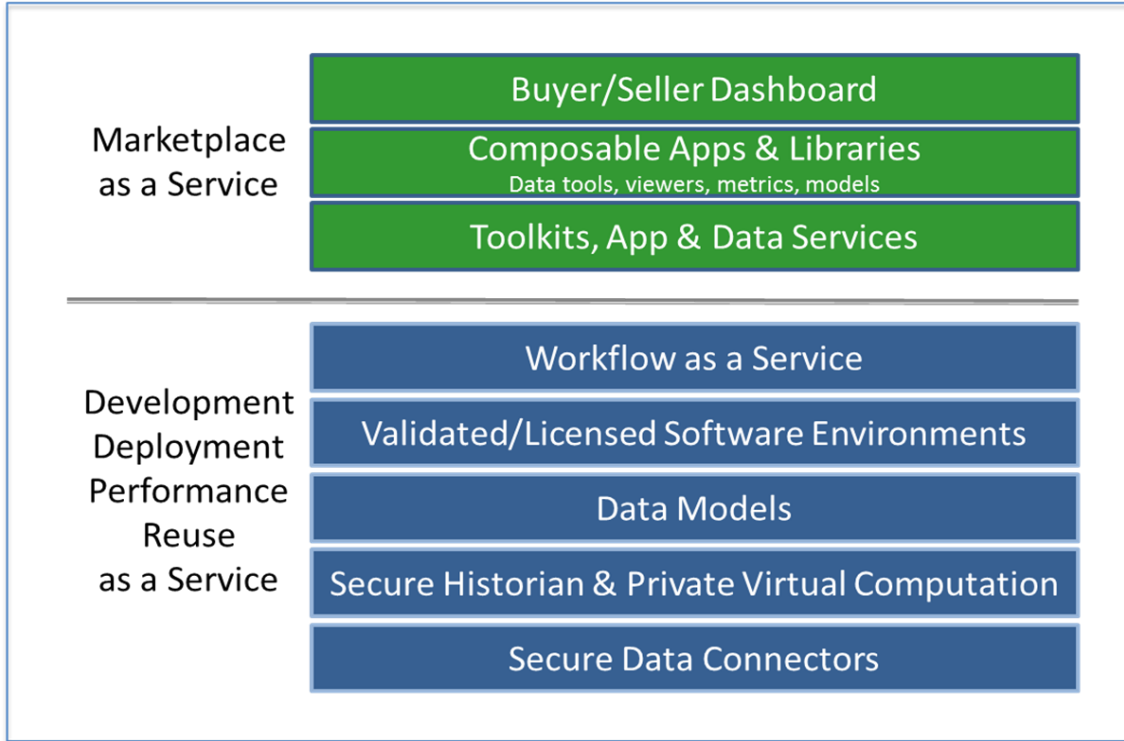Protocols/standards

Physical Systems

SCADA Supervisory Control and Data Acquisition **PLC** Programmable Logic Controller **HMI** Human Machine Interface

SM Platform™ Reference Model

Lightweight
Cloud Integration Service

Security
Interfaces
Virtual compartments
Scalable
Hardware of Choice

Different
Industry Marketplace
Industry Data Management
Engineering Workflow as a Service

How Is The PI System Used in the SM Platform?

- Aggregation and normalization by leveraging PI AF abstraction of customer process/production data

- Secure transfer of data (PI Cloud Connect) to the SM platform

- Provide real-time streaming analytics, data contextualization and intelligent data extraction for use by SM advanced analytics, models, and visualization systems

- Provide a secure bi-directional data transfer between the customer and the SM platform suite of advanced analytics

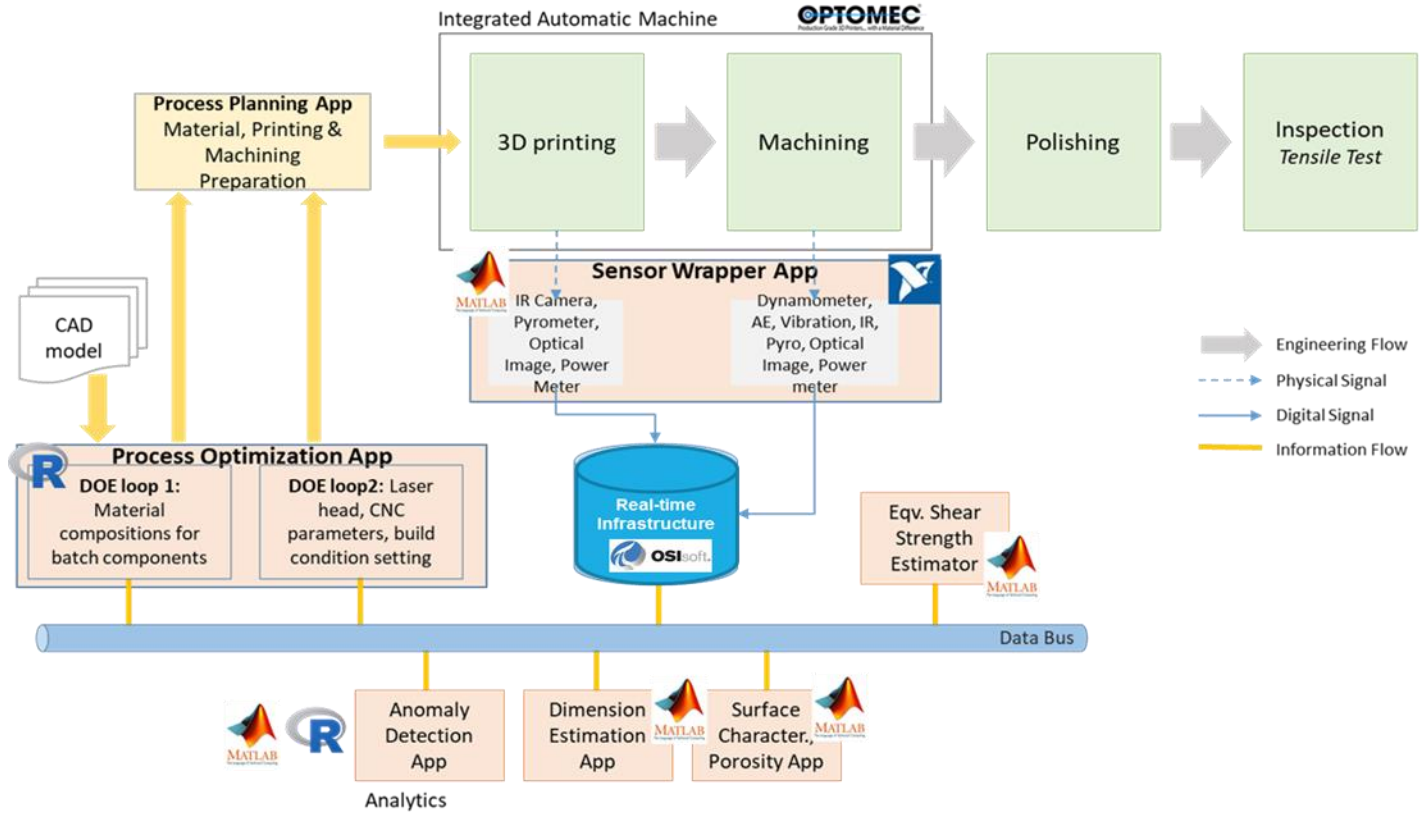# Example: Smart Manufacturing Process Optimization for Additive Manufacturing

SM Objective for Additive Manufacturing (AM)

- Demonstrate rapid optimization of the AM process and material designs in a hybrid manufacturing setup
  - Derive specified strength characteristics
  - Quickly optimize build and machining processes based on achieved results
- Needed capability for the industry segments engaged in insertion of new or modified materials, processes (e.g., shift to AM from a welded component), and equipment as part of their operations
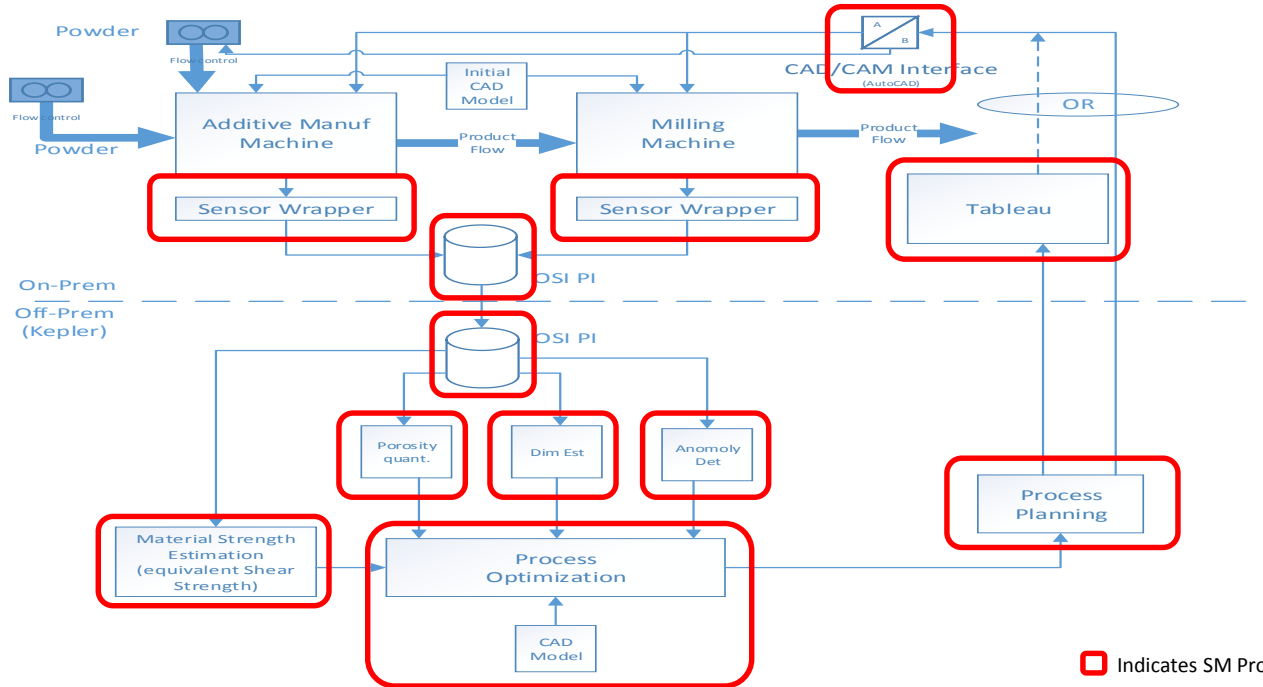
Additive Manufacturing SM Architecture

Additive Manufacturing Data Structure

SM Platform™
Data Flow at TX A&M Testbed

Predictive Analytics and Machine Learning

Modeling Software

Energy Cost Containment

Asset Efficiency & Fleet Mgmt.

Process and Quality Improvement

CESMII Smart Manufacturing Cloud OT/IT Analytics Platform (Digital Twin)

Cloud-based PI System Contextualization and Analysis

Advanced Visualization and Reporting

Business & Work Flow Data

Cloud Services

PI Cloud Connect

On-Premises PI System
(Data Aggregator/Context/Sensor Wrapper)

Operating Plant Data

Pilot Plant Data

IoT Sensors & Nat. Instr.

Local Plant Historian Data

Data Lakes & Manual Data

CLEAN ENERGY
SMART MANUFACTURING
INNOVATION INSTITUTE™

How Can You Work with CESMII?

Smart Manufacturing Product™ Development

- Researcher/company subject matter expertise

- Work with regional partners to develop testbed project proposals

  – Collaborative with regional/national partners

  – Responsive to technology roadmap

  – Scope and budget templates for projects

- Participate in Institute strategic planning activities at both regional and national levels: work with the region and industry partners

- Subscribe to Institute and regional communications channels to stay up-to-date with opportunities
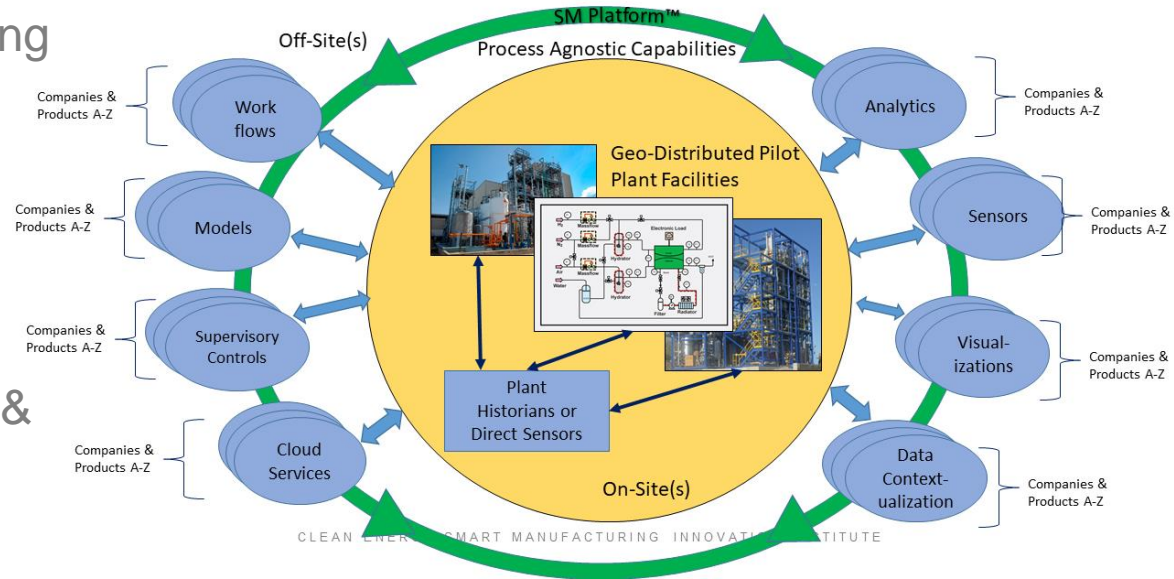
Gulf Coast Regional Test Bed Planning

Test Bed Planning Groups

- Discrete Unit Manufacturing
- Chemical Process Manufacturing
- Polymer Reaction Monitoring
- SM Integration of Process Intensification Technologies
- SM Enabled Decision Support & Training

Prospective Test Bed Functionality

Contact Information

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Questions

Please wait for the **microphone** before asking your questions

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감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado