Enterprise PI and the Digital Plant

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Agenda

- Introductions and About Eli Lilly and Company
- Digital Plant Vision and Business Challenge
- Enterprise PI as a Key Strategy
- Implementation Details
- Use Case – Global Energy Dashboard
- Conclusion
- Q&A

Global Fast Facts

A heritage more than **140 years strong,** founded on May 10, 1876

Headquarters located in **Indianapolis, Indiana**, U.S.A.

Approximately **38,000 employees** worldwide

More than **8,000 employees** engaged in research and development

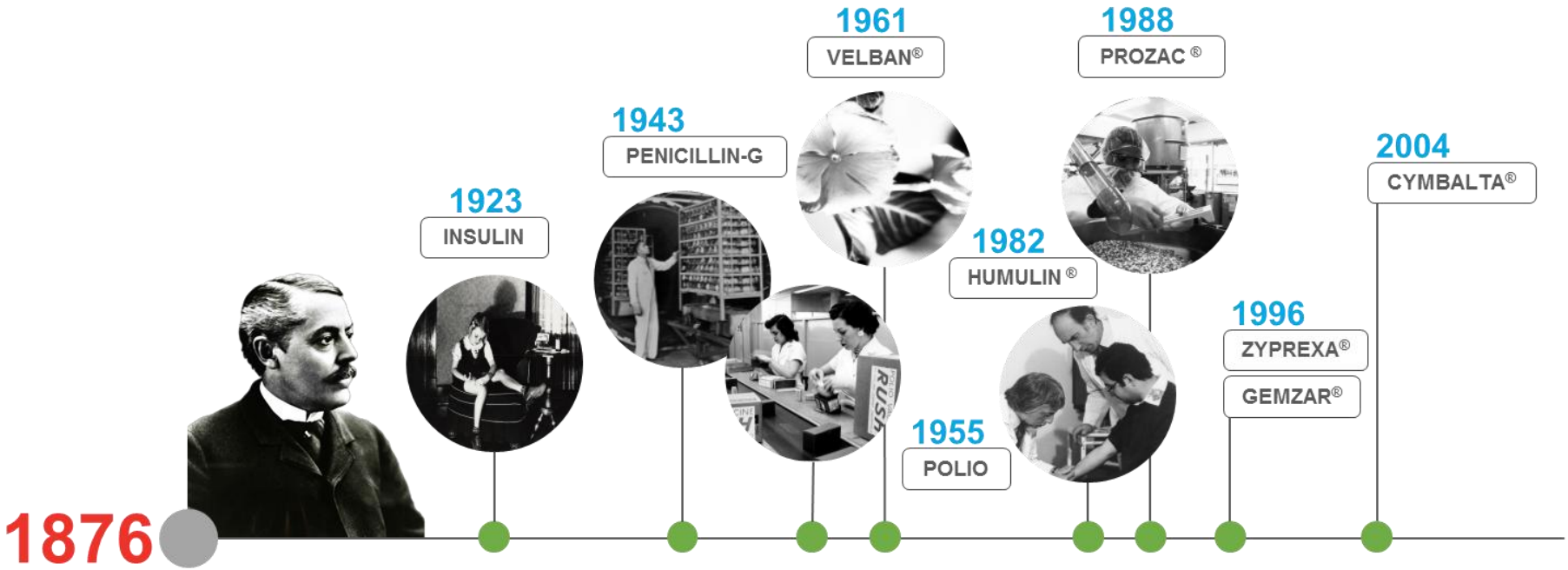
Clinical research conducted in more than **55 countries**

Research and development facilities located in **8 countries**

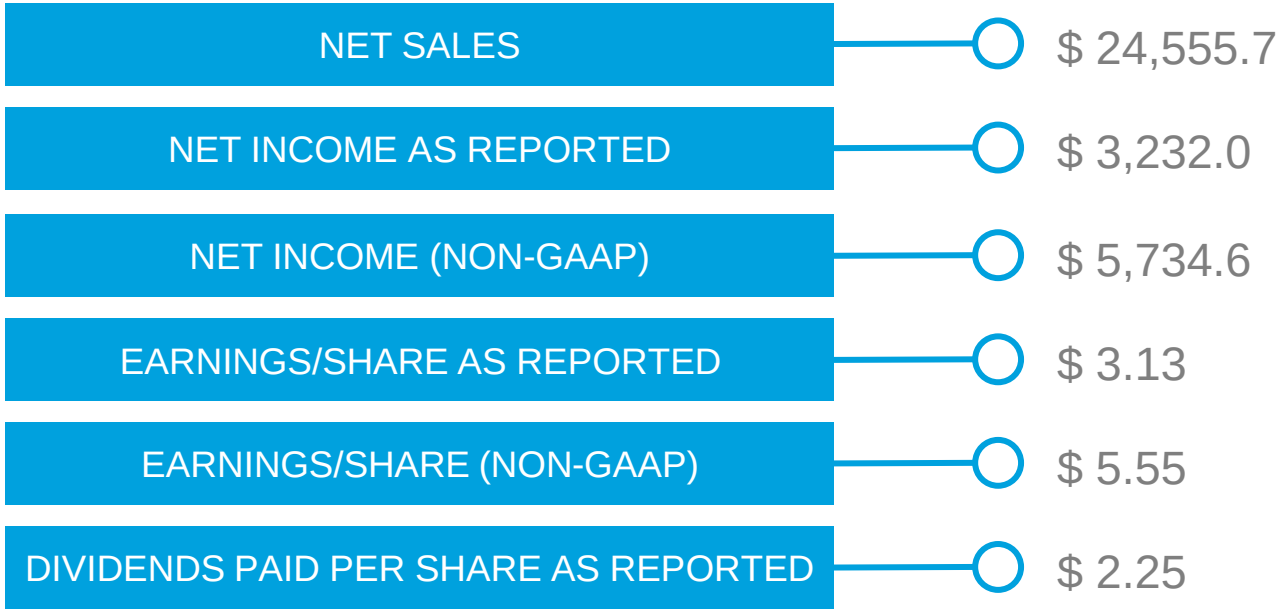
Manufacturing plants located in **8 countries**

Products marketed in **120 countries**

A Heritage of Discovery



Financials



(dollars in millions except for per-share data)

Our Strategy

Our fundamental strategy is predicated on discovering new medicines.
Lilly currently has one of the most robust mid-to-late stage pipelines in its history.

MOLECULE AND INDICATIONS IN REGULATORY REVIEW

MOLECULES AND INDICATIONS IN PHASE 3 CLINICAL DEVELOPMENT

MOLECULES AND INDICATIONS IN PHASE 2 TESTING

MOLECULES AND INDICATIONS IN PHASE 1 TESTING

**Numbers updated February 5, 2019*

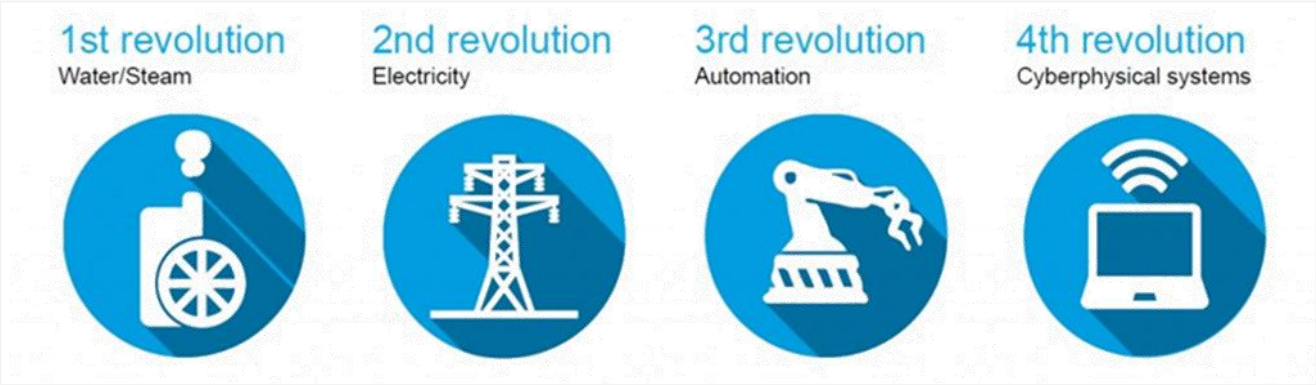
Our Global Presence

Updated: November 6, 2018

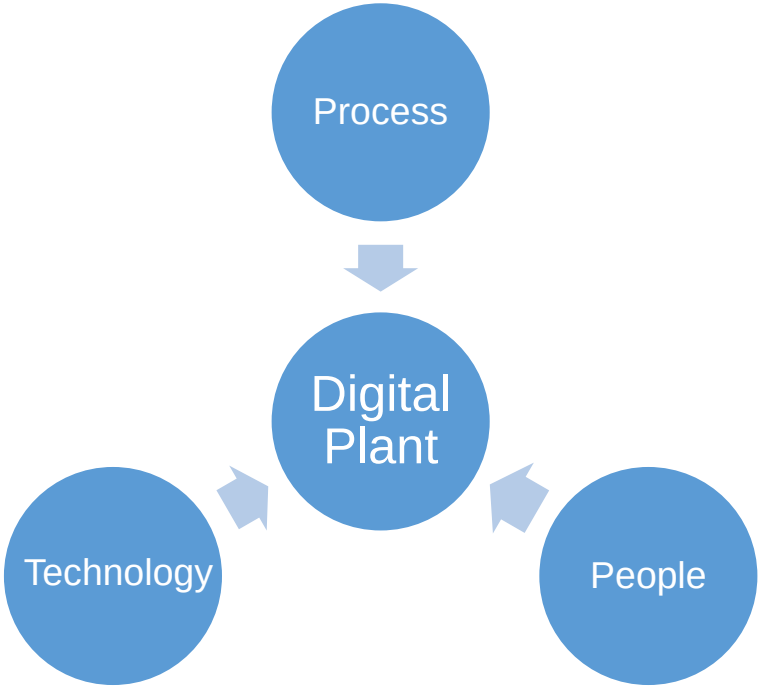
Digital Plant

Industrie 4.0 = Strategic Initiative by German Government

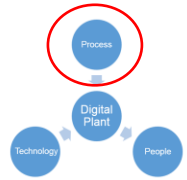
(Working Group Recommendations initially published in 2013)

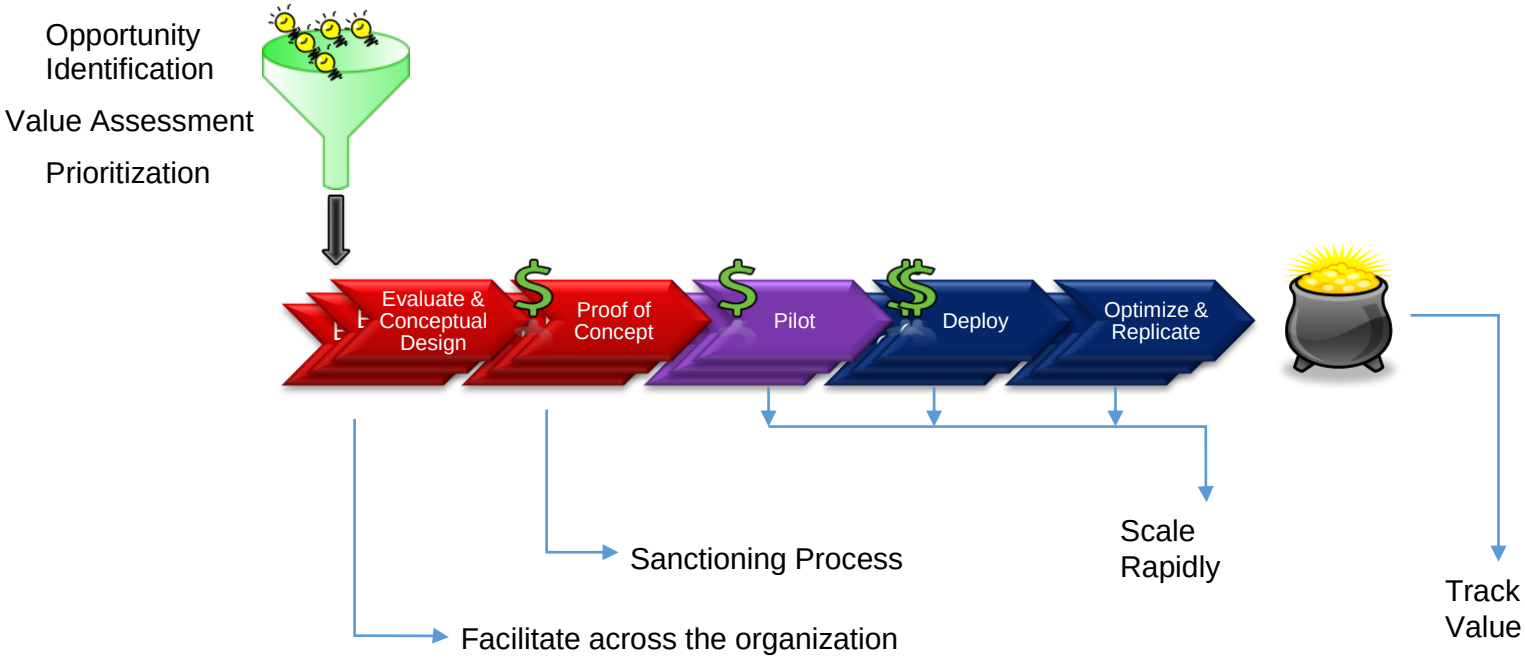


Enabling the Digital Plant Vision

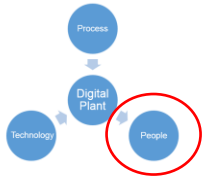


DP Process : Innovation Flow



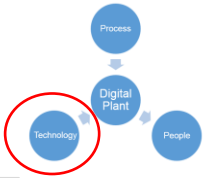


DP – People Strategy

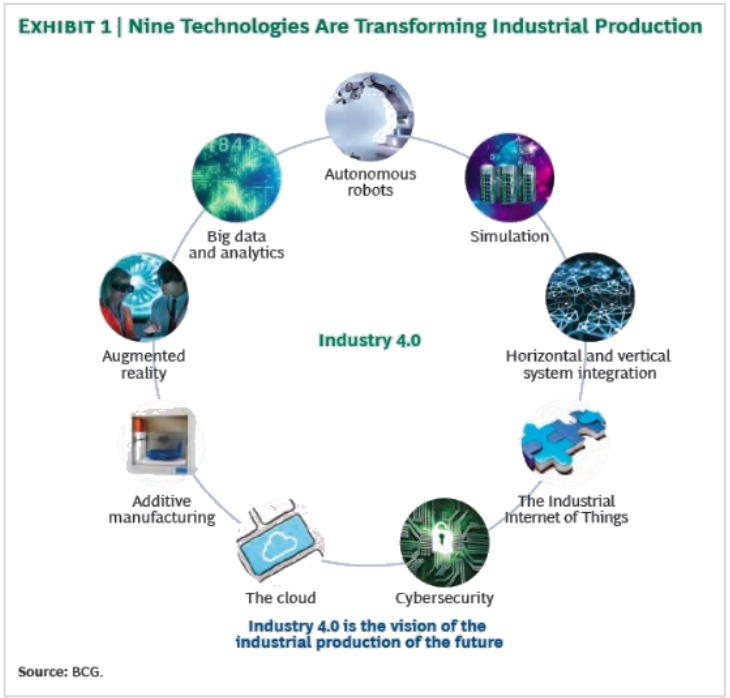


- Changing the culture
- Upskilling the workforce

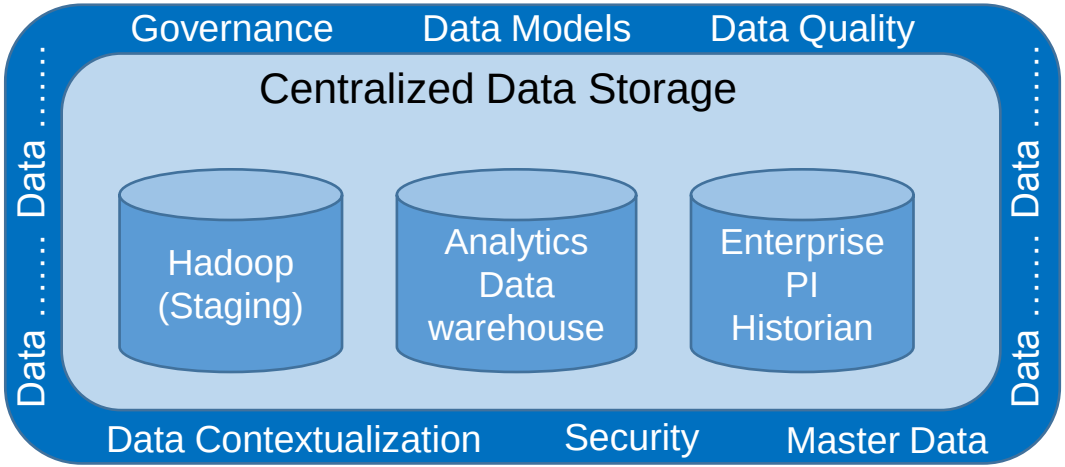
DP – Role of Technology



- Cyber Security
- Big data and analytics
- Robotics



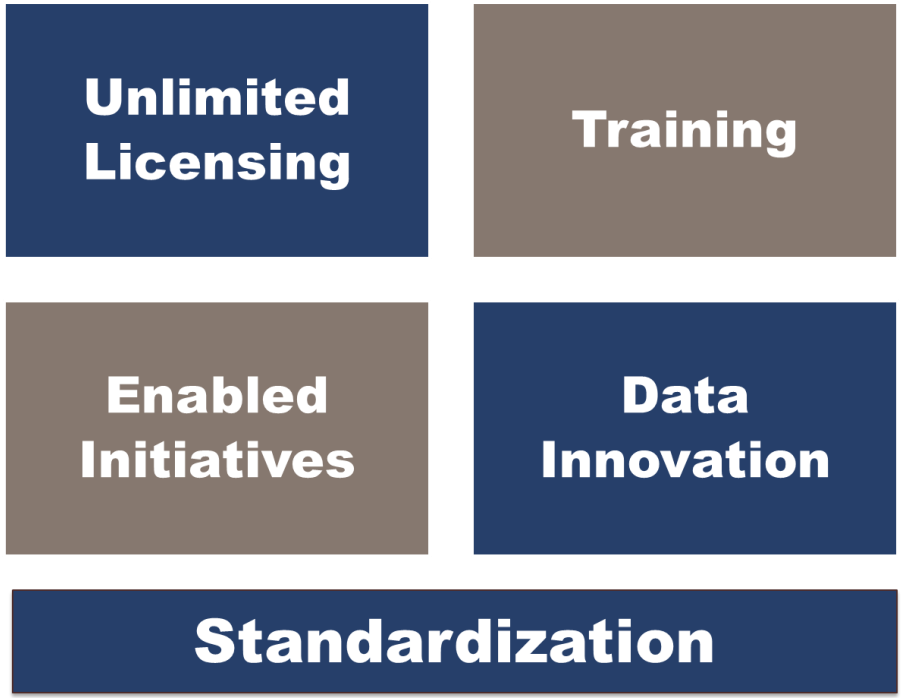
Digital Plant Vision – Centralized Data Architecture



Faster Business Outcomes

(Ability to scale from POC to Prod across all mfg sites).

Value of the EA



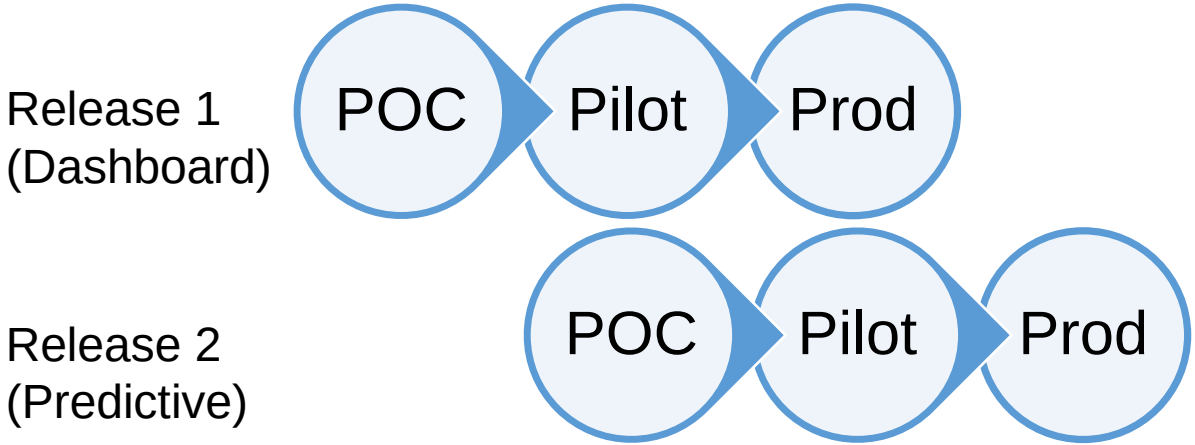
Innovation with the EA

- Removes activation barrier for collecting data and utilizing advanced analytics
- Price is not an excuse
- Faster adoption of newer tools such as PI Vision and AF/EF lead to better analysis and understanding of manufacturing data
- Removes limitation of who has access to tools ➔ Removes limitation on who can innovate
- Provides ability to innovate in a non-GMP environment before applying to GMP environment

Standardization with the EA

- Single integration point for process data
- Standard metadata
- Reuse / Replication
  - Additional savings
  - Avoid duplicate work

Enterprise PI and Advanced Analytics



We can continue to innovate and apply advanced analytics to one pilot site whilst the other sites are still being implemented.

Energy Dashboard – Business Need

Multiple sites with diverse energy assets and data capabilities

- No standard energy monitoring or reporting
- Various capacities, configurations, automation, data
- Regional climates and HVAC design philosophies
- Energy savings opportunities identified through manual investigation

Implement Energy Dashboard to provide:

- Energy monitoring across the enterprise
- Standard KPI reporting and benchmarking
- Energy fault detection

Energy Dashboard – Technology Selection

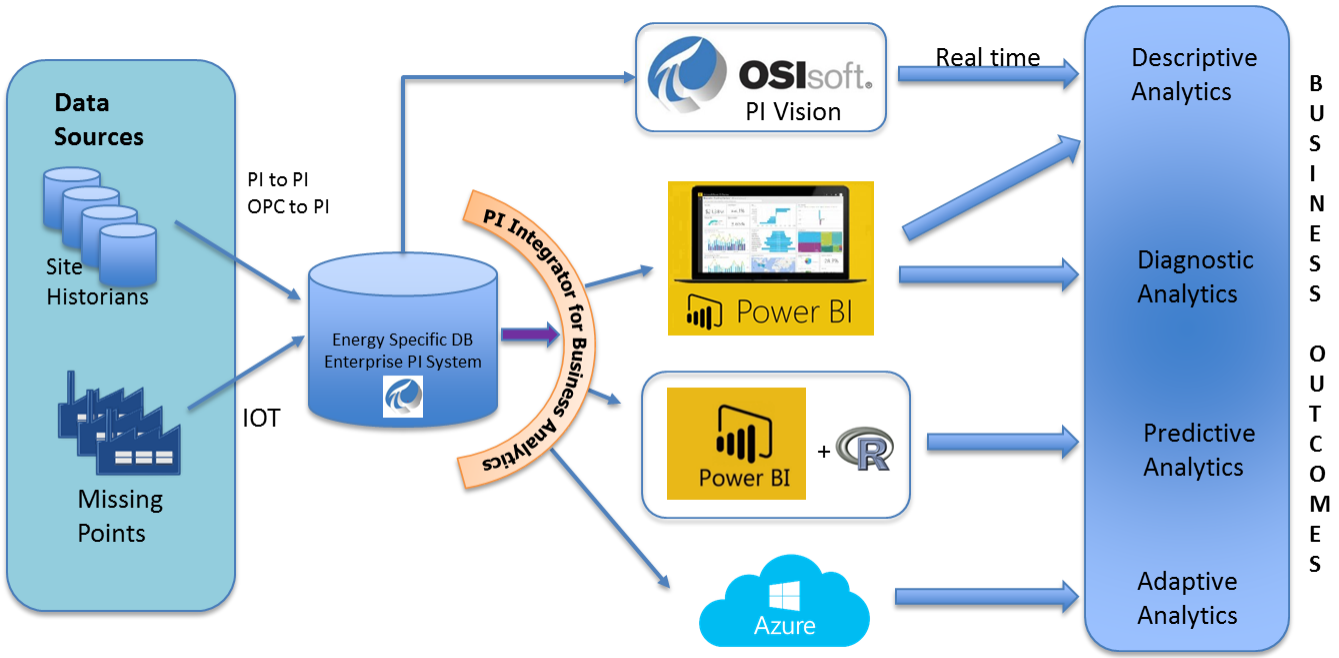
Options Investigated

- Commercial Off The Shelf (COTS) software: monitoring / fault ID / optimization
- Custom development within local automation systems

OSIsoft PI System selection

- Asset Framework (AF) functionality
  - Standard energy performance and fault identification logic
  - Templates for replication to all sites
- Leverage the EA to reduce local costs & resource requirements
- 1 interface for company wide energy data (standard naming)
- Integrate manufacturing and energy data

Energy Dashboard – Design



Energy Dashboard – Energy Data

Common energy data collected for all sites

- Site and building consumption
- Generation systems: boilers - chilled water - compressed air
- Air Handling Unit (AHU) systems

Building Meters	Generation Systems	AHUs
Electric	Input Energy	Inlet Air Temp
Steam	Energy Delivered	Heating Air Temp
Chilled Water	Calculate COP	Cooling Air Temp
Compressed Air		Valve Positions
		Calculate Energy & Faults

Energy Dashboard – Energy Calculations

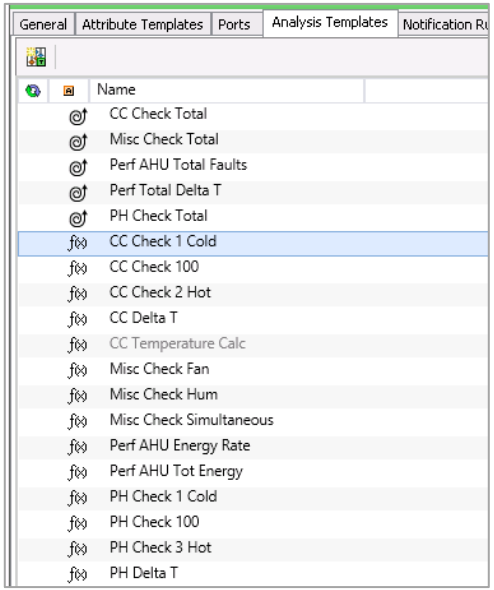
KPI parameters

Boiler	Input Fuel/Output Steam or COP
Chilled Water	kw/Ton or COP
AHU's	BTU/cfm

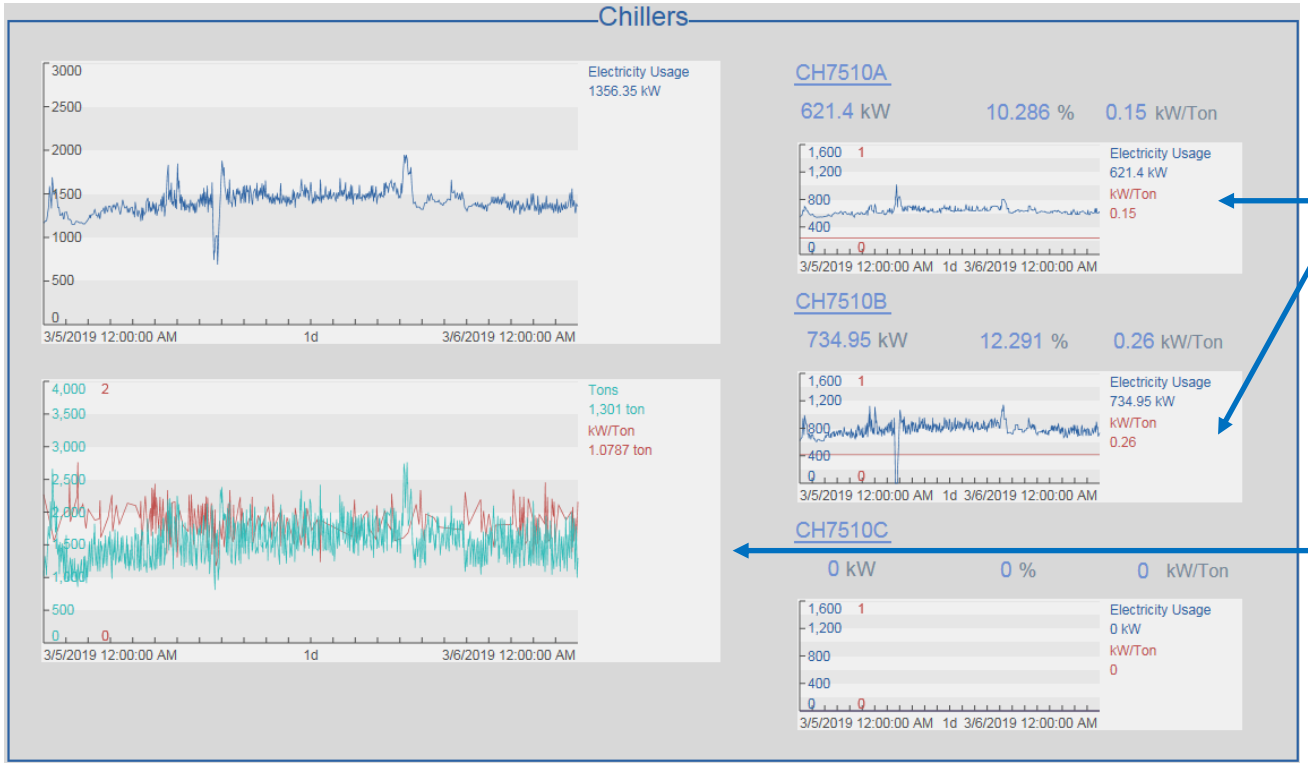
AHU air temperature faults

Economizer Operation	Simultaneous Heating/Cooling
Over Heating	Over Cooling
100% Conditions	

- All calculations standardized on Analysis Templates in AF



Energy Dashboard – Monitoring



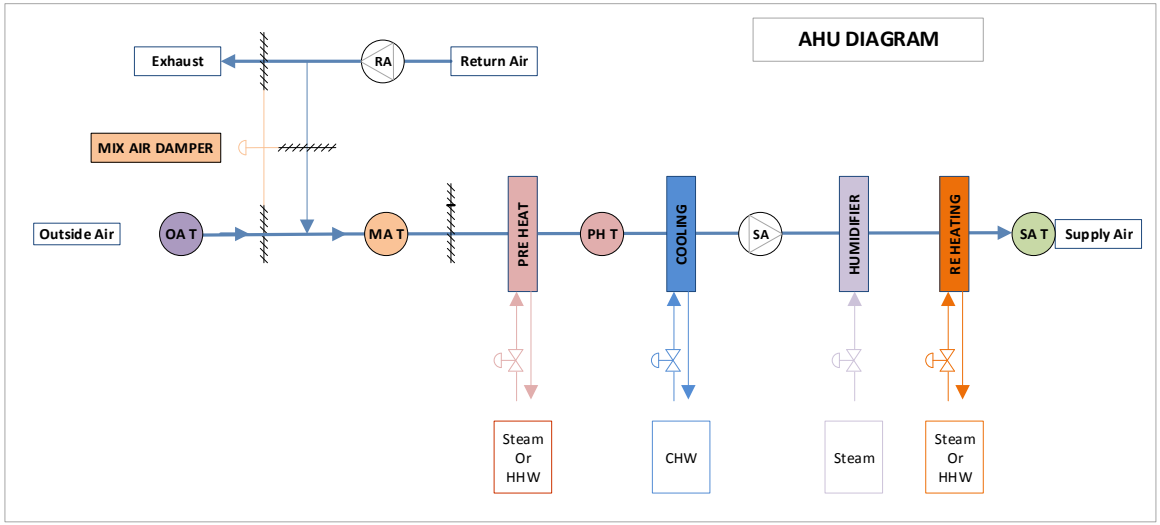
Individual Chiller
Consumption & Performance

CHW System
Consumption & Performance

Energy Dashboard – Faults

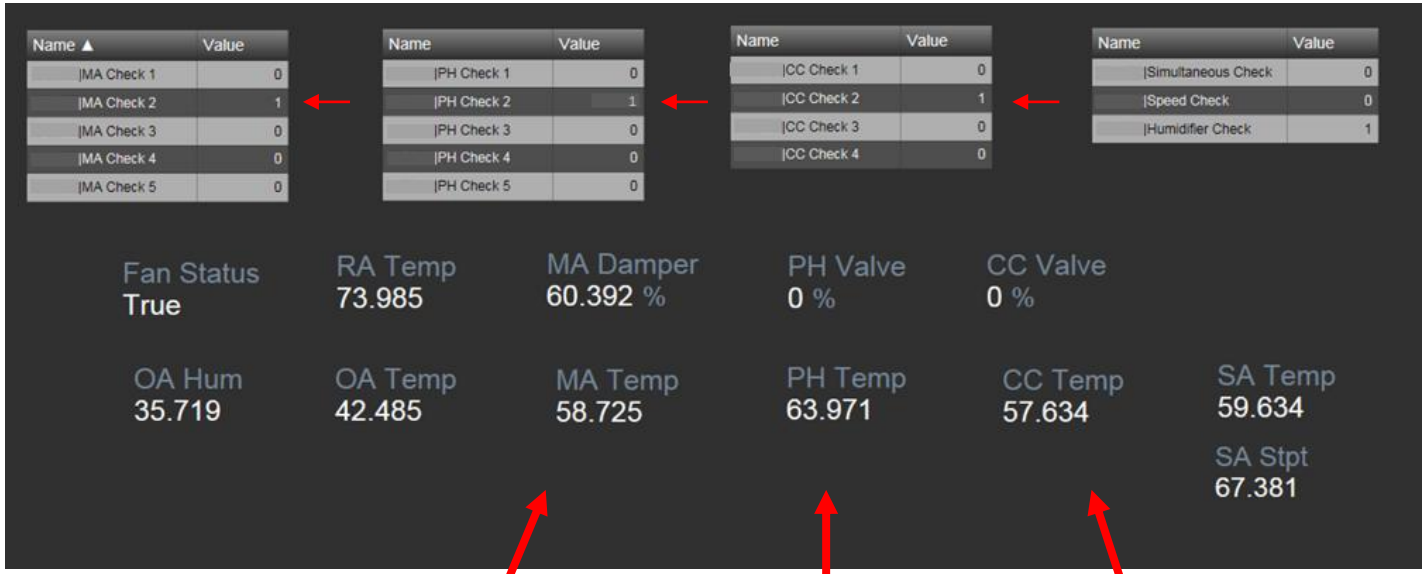
Typical AHU Layout

- Provide conditioned air
- Mix Fresh and Recirculated air
- Heating Coils
- Cooling Coils



- Base AHU template and 10 derived templates for specific AHU types
- Specific temperature faults for each AHU type

Energy Dashboard – Faults



Mixed Air Fault
Economizer should be meeting set point

Pre Heat Fault
Valve Closed
5F Temp Change

Cooling Fault
Valve Closed
6F Temp Change

Energy Dashboard – Implementation

Pilot - 6 months

- Develop KPI and fault calculations
- Create templates and deploy at 2 sites

9 additional sites - 4 months

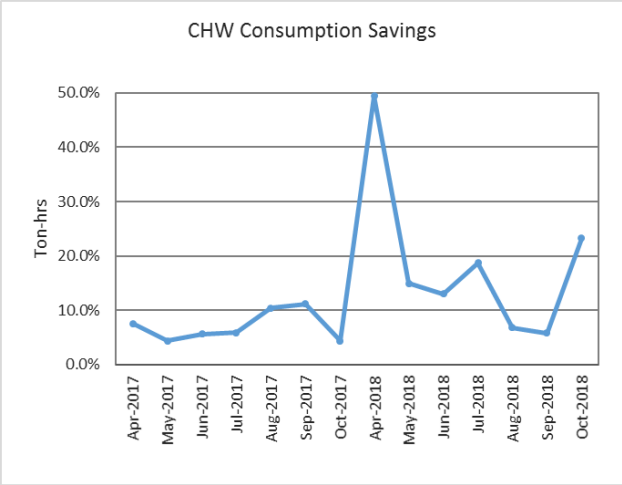
- Data connections & mapping
- Leverage standard templates to drive consistency and speed of implementation
- As soon as data connected → templates applied and dashboard live

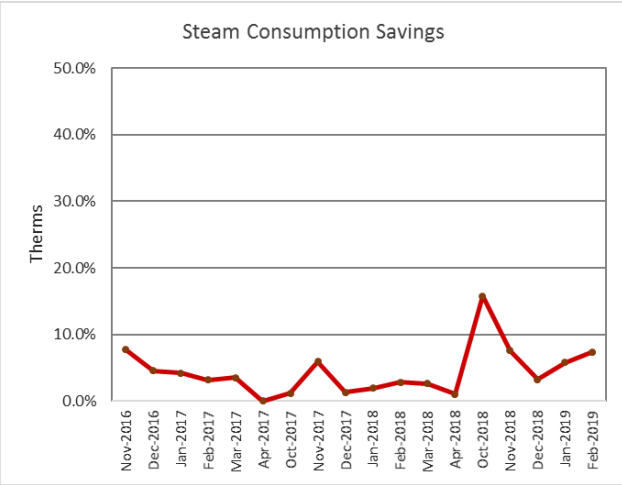
Potential Future Development

- Use Event Frames (EF) to capture duration of energy faults
- Analyze zone conditions downstream of AHU's

Energy Dashboard – Pilot Results

- Monthly prediction model based on 2012-2016 data
- Normalized for weather and occupancy
- Expect ~8% energy savings at any given deployment site



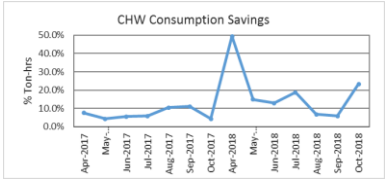


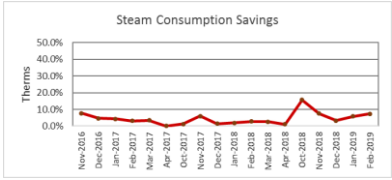
Enterprise PI deployment – Lessons Learned

- Partnership between IT & Engineering - support for interface issues
- Workshop with site representatives to gain alignment and investment in the dashboard
- SME's drive template development and roll out
- Data alone changes nothing – need to address the issues identified
- Plan for multiple standards for measurement (metric, English, etc.)
- Limit data flow to raw data – calculations and logic applied in AF
- Local non-GMP PI system helps speed adoption and innovation

Eli Lilly and Company

Enterprise PI and The Digital Plant





CHALLENGE

Deliver Digital Plant concepts to manufacturing areas.

- Improve access to data and productivity.
- Enable manufacturing sites to deliver results with speed, agility and reduced cost.

SOLUTION

Utilize the EA agreement to enable the Digital Plant concept

- Enterprise wide PI system with interfaces to local PI systems.
- AF used to develop common data sets, analysis, benchmarking and reporting.

RESULTS

Global Energy Dashboard for monitoring energy consumption

- Standardized KPI's and analytics.
- Rapid deployment to 9 sites
- ~8% energy savings after fixing identified issues

Enterprise PI and the Digital Plant

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Questions?

Please wait for the **microphone**

State your **name & company**

Please remember