Streamlining The Search for Energy Savings in Utilities

Texas Industrial Energy Efficiency Program

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Agenda

- Background and Context
- A Better Approach to Utilities
- Examples
- Closing and Discussion

What we do

We help sites to grapple with challenging industrial utilities.

Utility Focused Services

We help energy and industrial companies

- Tighten up operations
- Improve intelligently
- Plan for the future

Our utility services help your site

- Reduce your footprint
- Maximize what you’ve got
- Optimize capital expenditures

Utility Systems Are Important

- Utilities serve the needs of **multiple processes**
- They are the only systems than can impact an **entire operation**
- Demands on utilities can vary broadly – but rarely decrease over time

Utility Systems Are Tough

- They are **giant** – Most span the site
- They are **old** – Have been in service since the beginning
- They are **complicated** – Often a Frankensteined mess from multiple expansions
- Knowledge is **fragmented** – Breadth is too large, personnel is limited

Utility Systems Aren't Sexy

- Historically, utilities are low on the totem pole
- Improvements don't always have a clear or short-term ROI
- Utility projects are often driven by a process improvement's need or a recurring pain point

Utility Systems Are Full of Opportunities

- Reduce **energy** consumption
- Reduce **water** consumption
- Optimize operations
- Improve reliability and fault tolerance
- Process improvements

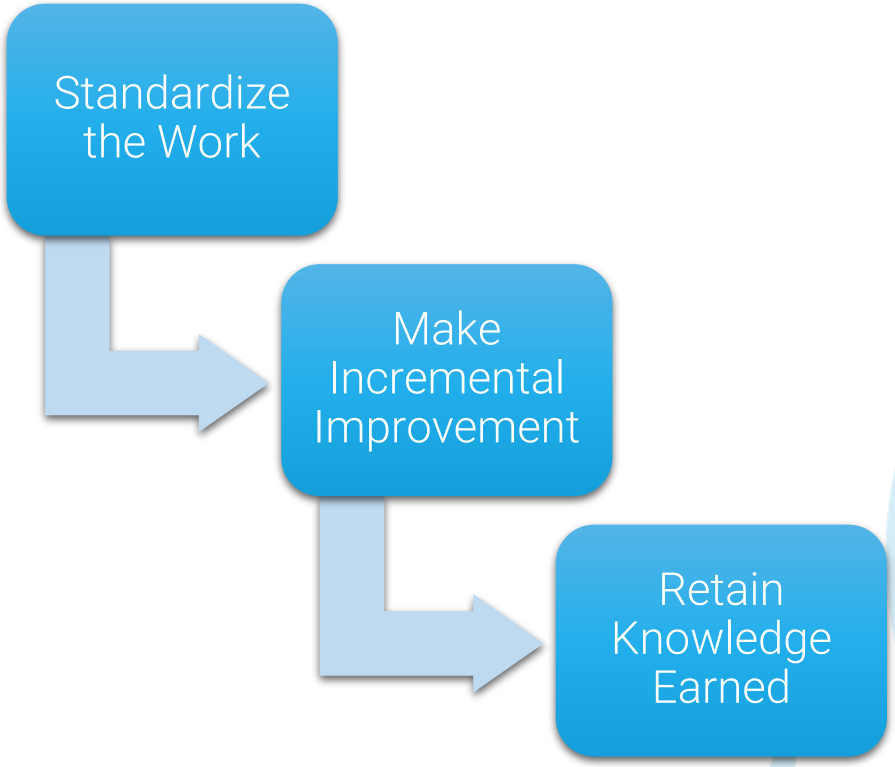
A Better Approach to Utilities

Utilities do best with a **Continuous Improvement (CI)** approach

Step 1 – Standardize the work

Step 2 – Make incremental improvements

Step 3 – Retain and fortify the knowledge earned



A Better Approach to Utilities

Utilities do best with a **Continuous Improvement (CI)** approach

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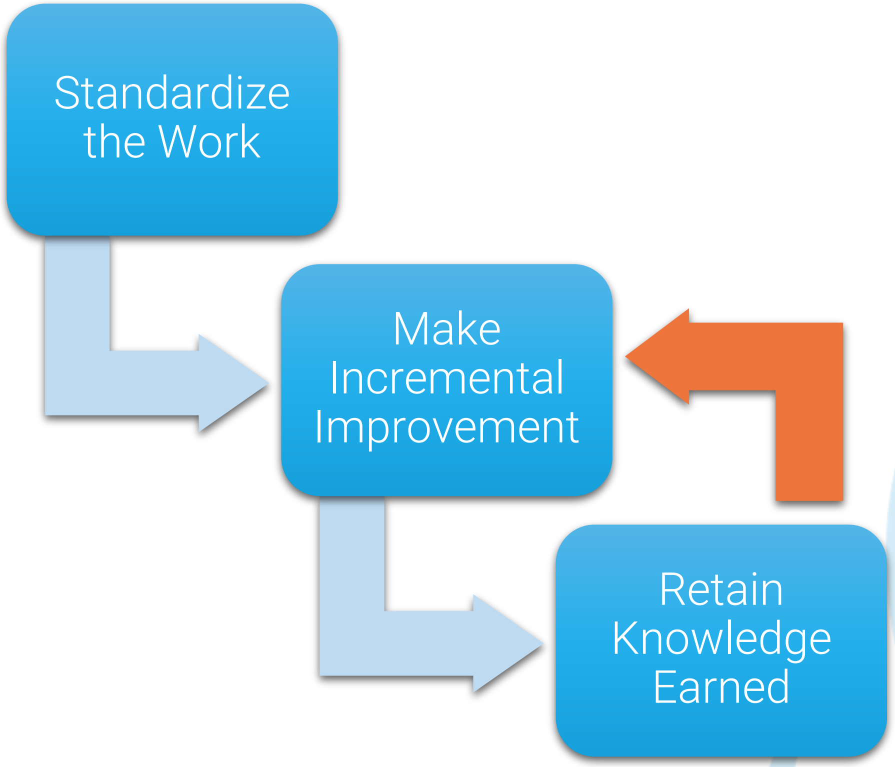
Now go back to Step 2



Where Do You Start?

At the beginning

What is an Industrial Utility System?

- The infrastructure and equipment used to provide essential resources to support processes (Water, steam, air, nitrogen, etc.)
- Consists of suppliers and consumers
    - Suppliers serve multiple consumers
    - Consumers vary in type, size, and location





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You Need a Tool

- There can be hundreds of components influencing a utility system
- Individual components are often well understood
  - They were designed and sized to meet a specific need
  - Under the assumption that the utility system will supply
- How the system and components operate as a whole – not always well understood
- **You're going to need an analysis tool that can help you understand how the system operates as a whole**

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The Right Tool

- A good analysis tool is ready to answer any question you can throw at it quickly and accurately
  - Operational demands, conditions, and capacities
  - Degraded conditions, issues and severity
- Should provide trustworthy, hard numbers
  - Shortfalls – GAP analyses, where does your system fall short?
  - What conditions put your system (and the processes they serve) at risk?
  - What future demands need to be met – How do you meet them?
- **A model is the right tool**

Not Just Any Model

- All components in a utility system are connected to a common pipe network
  - They are all hydraulically connected
  - Any one component can influence the entire system
- **A hydraulic model is the essential tool to understand a utility system**
- If developed correctly from the outset, the hydraulic model can form the foundation of a continuous improvement approach

How we do it

With a modern approach and the right tools

How we do it

Measure

We measure, collect, and generate relevant, real-world data. Better data yields better solutions.

Model

The devil is in the details. We execute complete, arms-around approaches to uncover opportunities.

Maintain

Things change overtime. We make sure you stay in front of problems and are ready for the next expansion.

Modeling Phases

1. **Phase I – The Bear Hug Phase**
   - Get your arms all the way around the system
   - Understand its demands, its capabilities and limitations
   - Once complete, you're ready to start answering the real questions
     (analysis, evaluations, what-ifs, etc.)
2. **Phase II – The Evergreen Phase**
   - Keep your arms around each system – Stay in front of problems and future needs
   - Prioritize, manage and develop plans to effectively meet demands and tackle issues quickly and effectively

Model Development

- Model must be developed to be comprehensive and multipurpose. Designed to answer any question.
- Aggregates all the key data
  - Design data – PFDs, PIDs, datasheets, etc.
  - Physical data – Layouts, locations, controlling factors, valve states, etc.
  - Historical data – Usage, trends, and demand cycles
- If your model is done right, its *better* than PFDS, PIDs, plot plans, datasheets, and PI data because it combines ALL that information into a single representation

Pro Tips – Model Development

- Be consistent – Formalize data and model standards
  - Models should look and feel similar (naming, colors, symbols, etc.)
- Traceability
  - References and data sources should be traceable
  - Document operating conditions, boundaries, and limitations
  - Maintain a chain of custody
- Strive to make the model the best starting point for a wide variety of tasks
- Commit the time
  - Modeling utility systems is a time and labor-intensive process
  - A larger system can take upwards of 3-4 months to complete

Evergreening

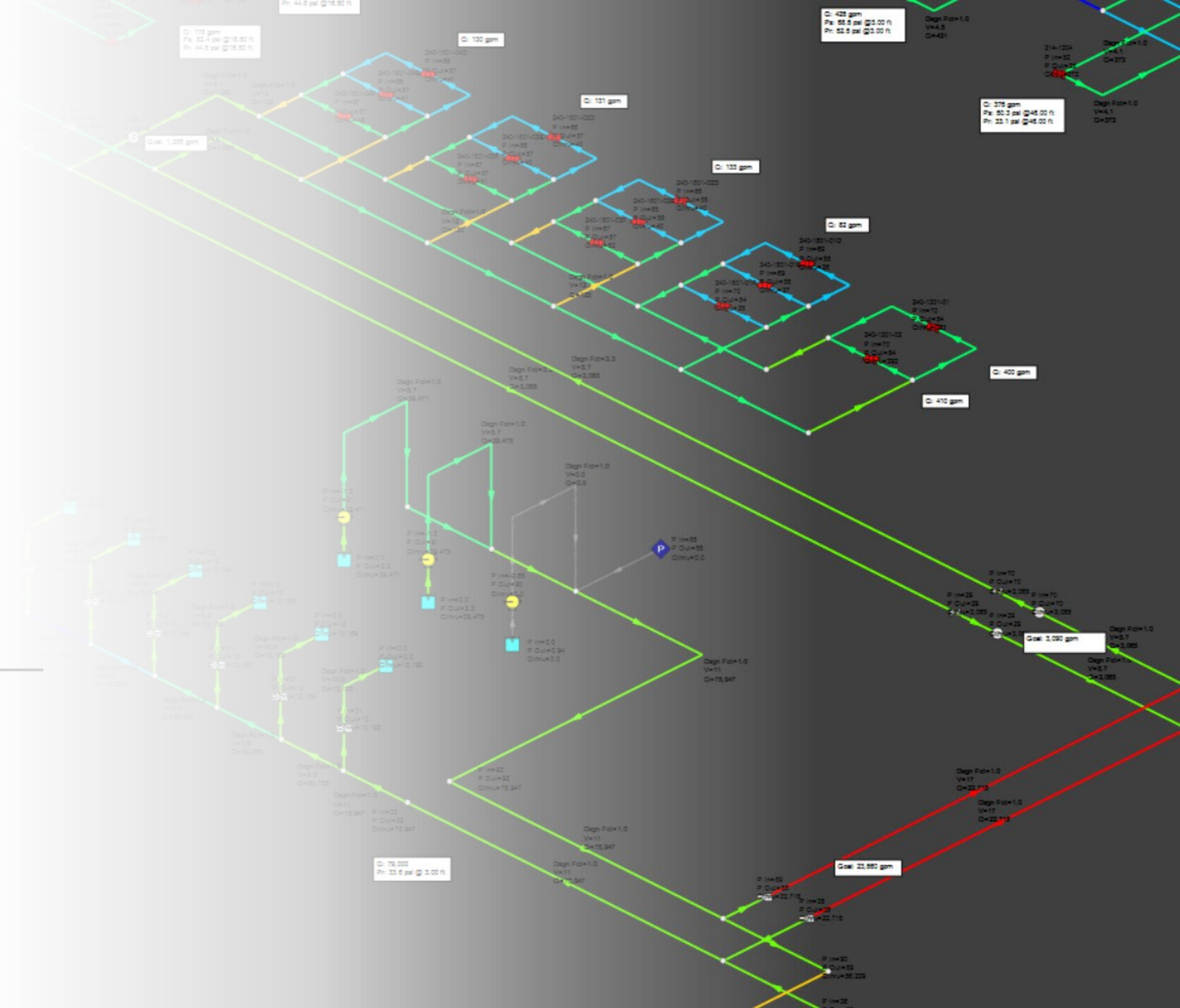
- Resist the urge to put the model on the shelf when your initial analysis is complete
  - The accuracy (and value) of the model degrades with time – don't let it expire
  - There will always be more questions to answer
- Commit to evergreen models and reference data
  - Integrate evergreening into your engineering phases, processes and cycles
  - Don't let the small details get lost in the noise

Pro Tips – Evergreening

- Be consistent – Formalize evergreening requirements
- Formalize routine refreshment and recalibration as part of the engineering and TAR cycles
  - Consistently remeasure and recalibrate to maintain accuracy
  - Require interim changes be included, this data will prove useful in retrospect
- Build institutional knowledge – Ensure knowledge sticks as people move up and move on
  - Have a central source that clearly documents a system's lineage
  - Implement a system to manage/track your system's ownership, changes, issues, project needs, etc.
  - Make it a company resource – others need access to this knowledge

Energy Savings Examples

Energy savings uncovered thorough hydraulic modeling



Boiler Feedwater Pumps

- (4) 600 HP pumps operating in parallel (continuous)
- Developed a hydraulic model
- Conducted field survey to validate the model
  - Pressure in 14 locations
  - Flow in 8 locations
- Control point adjustment allowed shutdown of (1) 600HP BFW Pump
  - **10,738 kWh/day savings**

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Raw Water Pump Optimization

- (5) Pumps feeding two interconnected clarified water systems
- Developed a hydraulic model and conducted field data survey to validate the model
- Determined most efficient pump combinations
  - **1,600 kWh/day savings**
  - Reduced wear on control valves at clarifier inlets

The Cost of a Spillback

- Utilizes a spillback valve set to maintain 150 psi system pressure
- Energy wasted through spillback
  - **3,608 kWh/day**
- VFDs can turn pump down in lieu of spillback

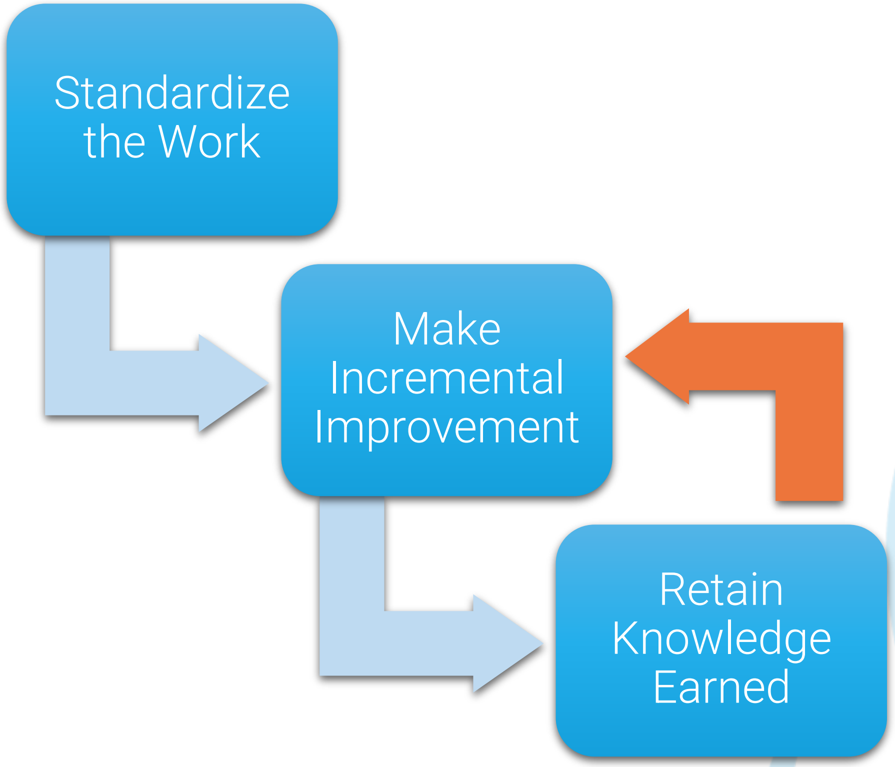
Food for Thought – Where to Look for Energy Savings in Utilities

- Parallel or multi-pump systems
  - Optimize pump combinations – especially if they aren't clones. Not all pumps play well with others
  - Consider the impacts of operating less pumps
- Control
  - Spillbacks are wasted energy
  - If you're burning pressure to control, you're wasting energy. Consider a VFD
- Piping – Overloaded pipes take more energy to push through
- Leaks –Steam, air, and gasses (*and* insulation)

A Better Approach to Utilities

Step 1 – Standardize the work

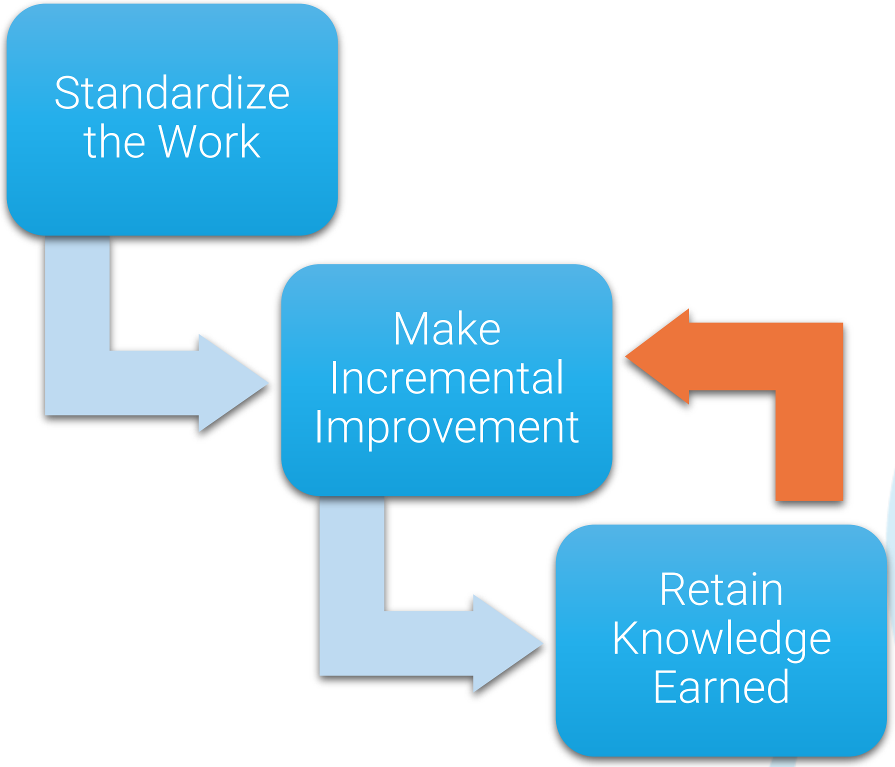
- Require comprehensive hydraulic models be developed for major utility systems
- Require modeling of impacts of *any* changes
- Evergreen models and reference data



A Better Approach to Utilities

Step 2 – Make incremental improvements

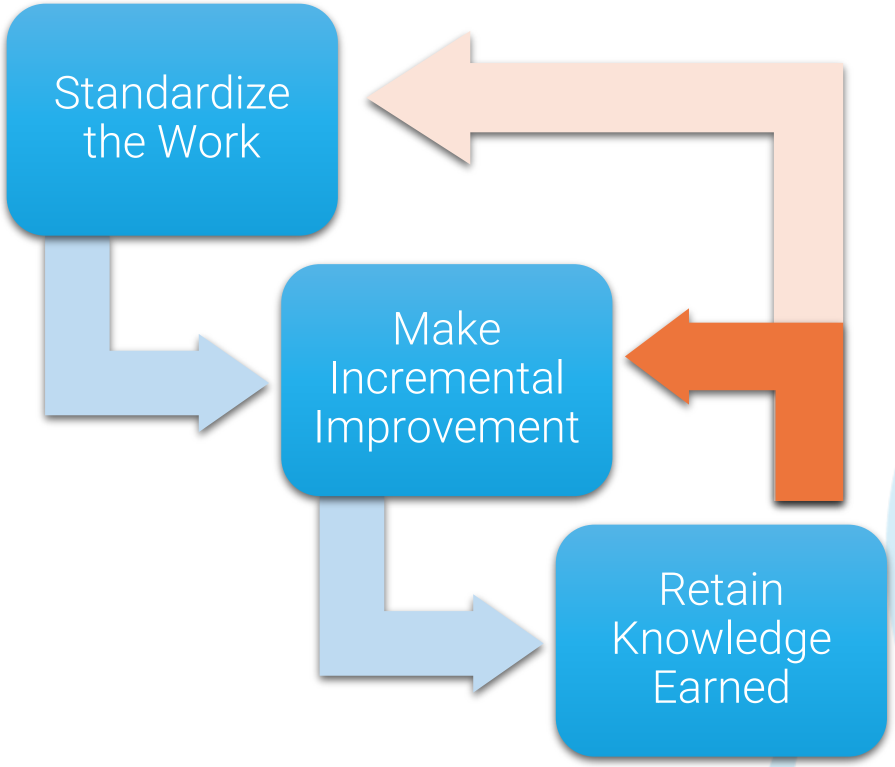
- Leverage the model find opportunies and inefficiencies
- Accept small changes and improvements
- Consider small improvements every time a project touches utilities



A Better Approach to Utilities

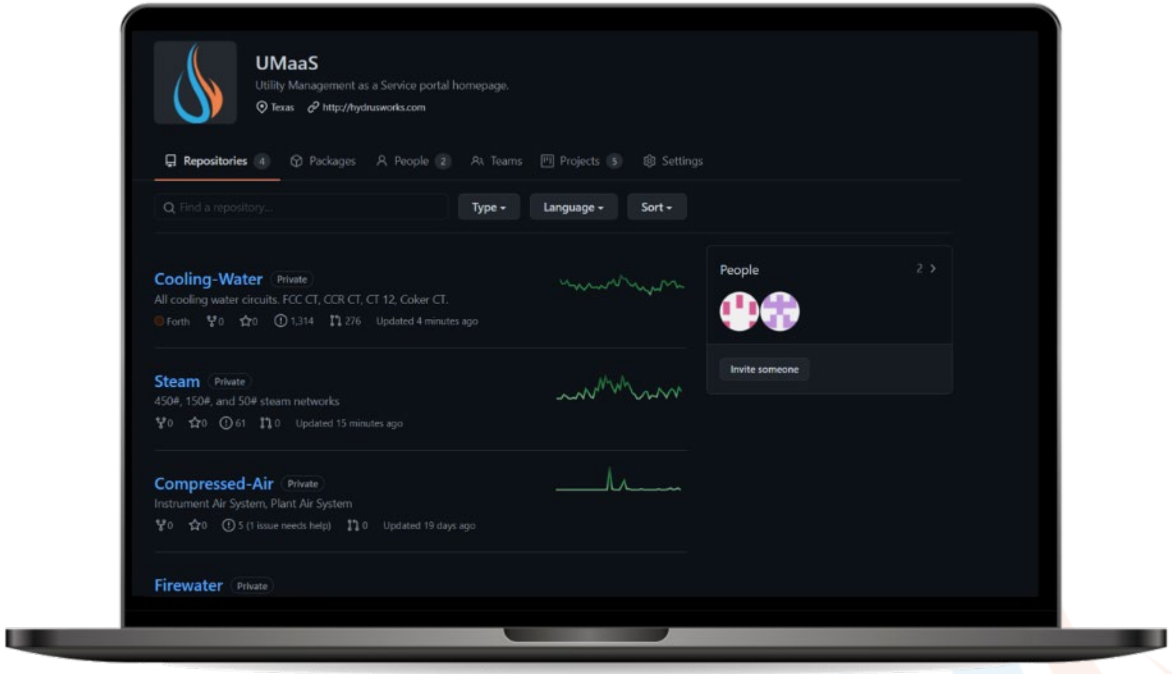
Step 3 – Retain and fortify the knowledge earned

- Build history and institutional knowledge – don't fight the same battle twice
- Formalize revision control, build a chain of custody, and fortify reference data
- Revise your standards (if needed)



UMaaS – Utility Modeling as a Service

- We build and maintain a library of utility models and data
- Maximizes your site's utility engineers with evergreened, trustworthy tools at their fingertips
- Free the to focus on the bigger picture to support the projects, operations, and maintenance



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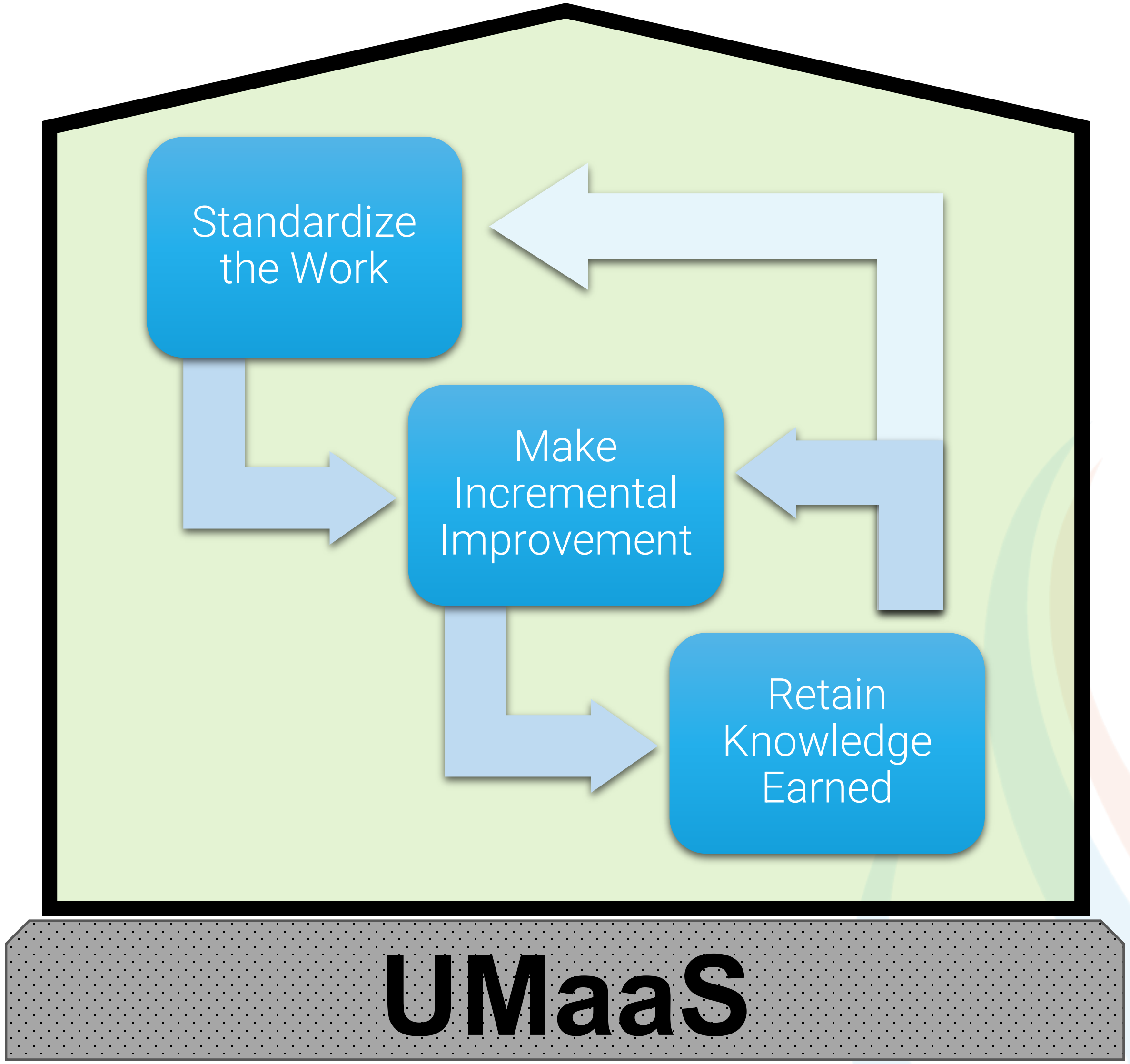

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Thank you!

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