

# Advanced Manufacturing Office

U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy



Tools & Training

Technical Assistance Partnerships

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On behalf of Sandy Glatt

Advanced Manufacturing Office (AMO)

# AMO Energy Tool Suite

## Goals

- Tools allow users to perform field validation, model and optimize energy using equipment and systems in manufacturing (and other large energy using facilities)
- Open-source approach enables greater transparency, community adoption, and integration into future technologies (i.e. – “Internet of Things” devices, machine learning optimization, etc)
- Low-cost and unbiased means to:
  - Identify and analyze opportunities to improve and optimize current energy use
  - Identify opportunities for new or enhanced technology needs related to manufacturing energy use
  - Validate and verify new technology enhancements

# AMO Resources: 3 Key Tool Focus Areas

## Energy Performance Tracking

### Baselining Navigator & EnPI Tool

Corporate Energy  
Performance  
Tracking for Better  
Plants partnership

Facility Energy  
Performance  
Tracking for Superior  
Energy Performance

## Energy Management

ISO 50001  
Implementation

Energy Footprint Tool

PEP (Plant Energy  
Profiler)

## Energy Systems Analysis

- Motors
- Pumps
- Fans
- Compressed Air
- Steam
- Process Heating
- Data Centers
- Simple Calculators

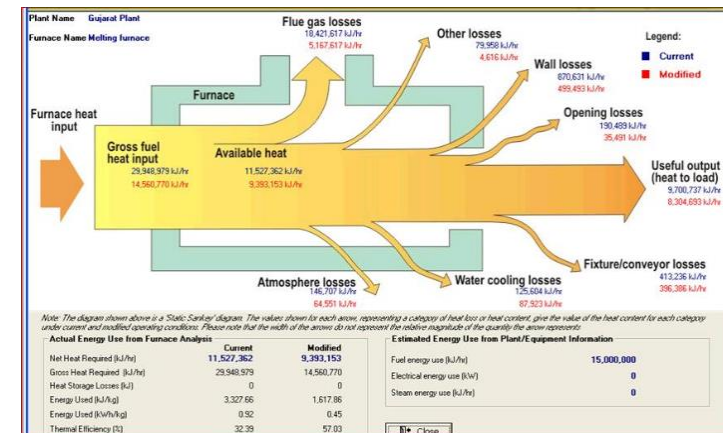
# AMO Energy Tool Suite

- Energy System Tools
  - Pumps, fans, compressed air, steam, process heat and motors
- Energy Management Tools
  - *50001 Ready Navigator*: Free online guide to help develop a robust EnMS consistent with ISO 50001
  - *Energy Performance Indicator (EnPI Lite) Lite tool*: Free web-based, online tool to help a facility establish baseline of energy consumption and track annual progress of energy performance, energy savings, and energy performance indicators
  - *EnPI tool*: Free Excel-based, downloadable tool (offline) with the additional functionality of accounting for variables and performing more robust regression analysis compared to EnPI Lite
  - *Energy Footprint tool*: Helps manufacturing, commercial and institutional facilities to track their energy consumption, factors related to energy use, and significant energy end-use
  - *Automated Register of Implemented Actions*: Free Excel download to organize and track actions taken to implement an EnMS, including but not limited to ISO 50001 and SEP



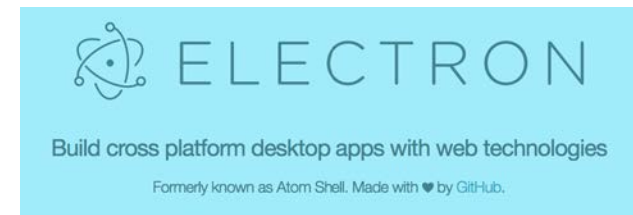
# AMO Tool Modernization Overview

- Issues:
  - Many tools no longer work with updated operating systems
  - DOE does not own software code
  - Difficult to fix bugs or add new capabilities
- Path Forward:
  - DOE will own and control code
  - Upgrade tool capabilities where feasible
- Create Open Source Software!
  - Government-wide Open Source Software  
<https://sourcecode.cio.gov/>
  - “...free Software for other public agencies as well as the general public to use, study, share and improve the software.”
  - MIT License – “Do whatever, but please provide attribution”



# AMO Tool Modernization (cont.)

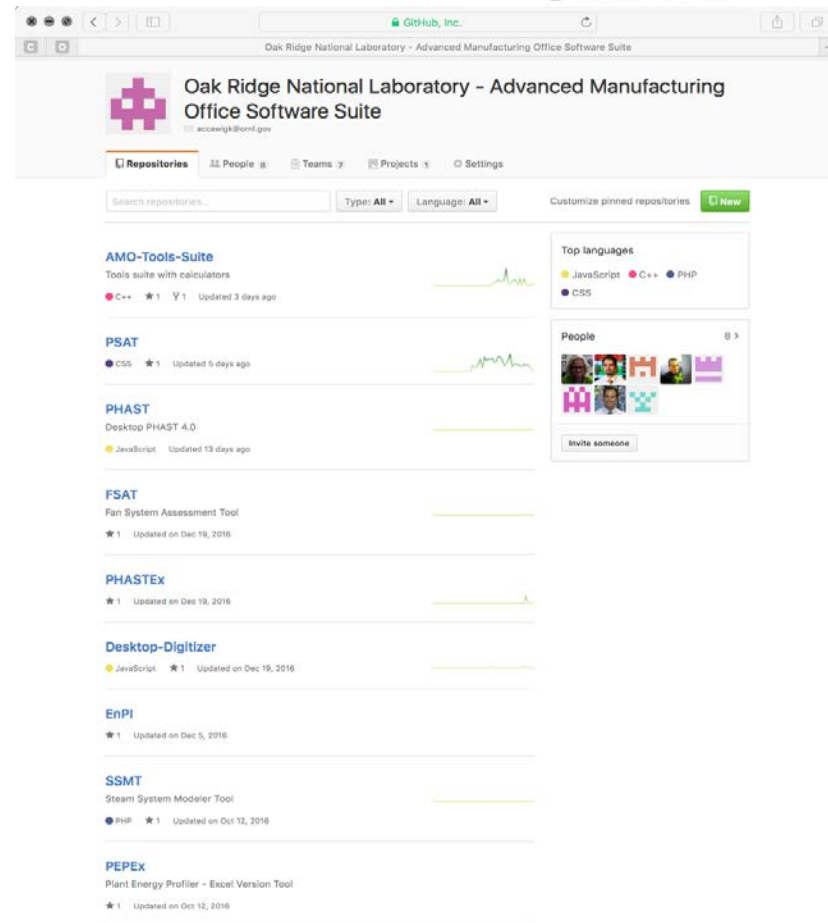
- Designed for Multiple interfaces
  - Web / Desktop / Mobile
- GitHub repository for Open Access
- <https://www.energy.gov/eere/amo/advanced-manufacturing-office-software-suite-github>
- Other Benefits:
  - Common software engine library
  - Auto-Update capability (silent updates)
  - Crash reporting to assist in debugging
  - Consistency in appearance across all platforms
  - Enhanced tool interoperability



# Open-source code

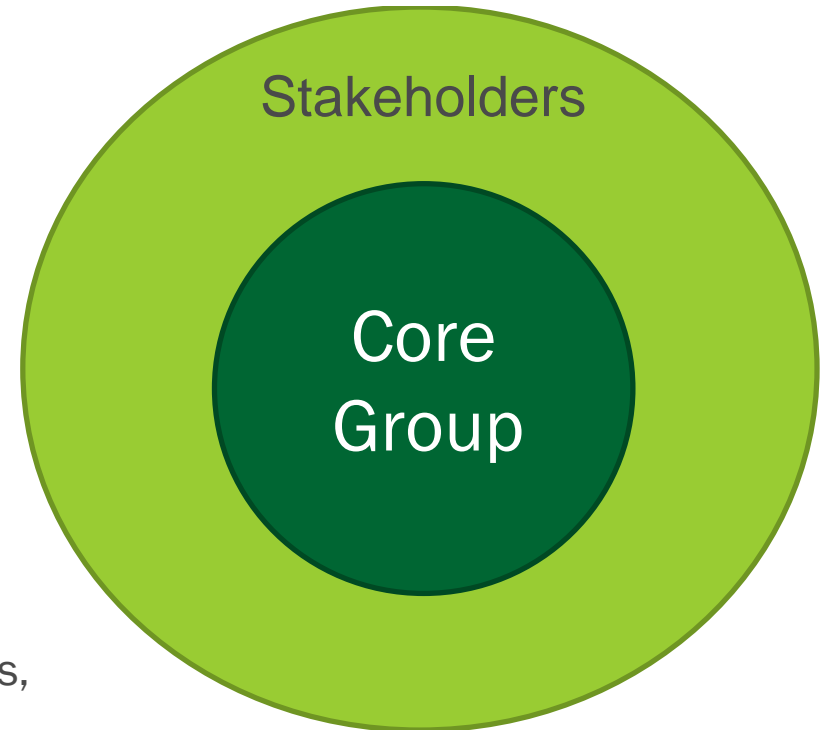


- Utilizing industry-recognized open-source code sharing platform
- GitHub.com - <https://www.energy.gov/eere/amo/advanced-manufacturing-office-software-suite-github>
- Provides versioning control
- Allows individuals to follow progress and push suggested modifications
- Repository Includes:
  - Source code, license info, configuration files, inline documentation utilizing doxygen



# Development: Critical Community Engagement

- Core Development group
  - Review coding
  - Test Beta Tools
  - Includes original tool developers and practitioners
- General Stakeholders' group
  - General awareness
  - End users of tools
  - Includes stakeholders in other DOE technical programs (Better Plants partners, Industrial Assessment Centers, etc)
- Periodic meetings
  - Update on development plans
  - Review and assess





# Tool Revamp Timeline

- Pumps (PSAT) - 6/30/2017 (alpha completed)
- Process Heat (PHAST 4.0) - 8/31/2017
  - (Excel version finalized) - **12/31/2016** (completed)
- Fans (FSAT) - 12/31/2017
- Compressed Air (AirMaster+) - 5/31/2018
- Steam (SSMT/SSAT) - 9/31/2018
- LogTool - 9/31/2018
- MotorMaster - TBD
- PEPEX - **3/20/2017** (completed)
- EnPI v5.0 - 6/30/2017
- 50001 Ready Navigator - **5/17/2017** (completed)
- EnPI-Lite - **5/31/2017** (completed)

# Associated Tool Training Plans

- Online Tool Tutorials – Tool-use tutorials will be developed for each tool (online, video)
  - Resources embedded in the tools or otherwise available instructing users on how to use the tools
- In-Plant Training- Expanding deployment of In-Plant training curriculum (classroom/in-person)
  - System based and energy management with tool introduction
  - updated curriculum combining online and classroom modules with hands-on and participant interaction focus
- Expertise/ Certification Training - Explore 3<sup>rd</sup> party development and implementation of professional certifications in key systems
  - look to external organizations to develop and deliver (ex: Compressed Air Challenge, CAGI, IHEA)
  - Hydraulic Institute is completing a Pump System certification w/ associated curriculum
  - *Compressed Air Challenge* has Compressed Air System curriculum



# Future Technology Leverage Opportunities

What will this effort help enable going forward?

- Open-Source Library Suite
  - Greater transparency
  - Future proofing
  - New algorithms can be added to characterize other plant processes and equipment
  - Equipment providers can develop equipment specific databases that interface with the tool
- Library can be used to effectively test real-world equipment performance versus theoretic capabilities
- Leverage sensors for real-time data collection, monitoring and optimization
  - Leverage the Internet of Things devices coming online within manufacturing
- Enable real-time system analysis and optimization
  - Possibilities for exploring machine learning algorithms for system optimization