MANUAL

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FORCE Software Requirements Specification

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1 Introduction

The Framework for Optimization of ResourCes and Economics is a collection of software tools,models, and datasets acquired and developed under the Integrated Energy Systems (IES) program to enable analysis of technical and economic viability of myriad IES configurations. FORCE is the consolidating interface and data repository for all the IES toolsets ranging from macrotechnoeconomic analysis to transient process modeling and experimental validation for integrated energy systems. This document is aimed to report and explain the FORCE software requirements.

1.1 Other Design Documentation

Also available within the repository is the FORCE User manual within the "docs" folder. This user manual gives a detailed explanation of the installation process, system dependencies alongside links upon which where to find them, and an explanation of the use cases within the repository.

1.2 Dependencies and Limitations

The software should be designed with the fewest possible constraints. The only primary constraint is:

1. Python 3 – `https://docs.conda.io/en/latest/miniconda.html`

However, enhanced capabilities will require the installation of the aforementioned plugins (HYBRID, HERON, RAVEN, TEAL) which have the dependencies shown below.

RAVEN

1. Visual Studio Community Edition – Link Available on the raven github
2. Raven specific python library set. – Available through the install process.

HERON, TEAL

1. Risk Analysis and Virtual ENviroment (RAVEN) – `https://raven.inl.gov/SitePages/Software%20Infrastructure.aspx`

HYBRID

1. Commercial Modelica platform Dymola – https://www.3ds.com/products-services/catia/products/dymola/latest-release/

2 References

- ASME NQA 1 2008 with the NQA-1a-2009 addenda, “Quality Assurance Requirements for Nuclear Facility Applications,” First Edition, August 31, 2009.
- ISO/IEC/IEEE 24765:2010(E), “Systems and software engineering Vocabulary,” First Edition, December 15, 2010.
- LWP 13620, “Managing Information Technology Assets”

3 Definitions and Acronyms

3.1 Definitions

- **Baseline.** A specification or product (e.g., project plan, maintenance and operations [M&O] plan, requirements, or design) that has been formally reviewed and agreed upon, that thereafter serves as the basis for use and further development, and that can be changed only by using an approved change control process. [ASME NQA-1-2008 with the NQA-1a-2009 addenda edited]
- **Validation.** Confirmation, through the provision of objective evidence (e.g., acceptance test), that the requirements for a specific intended use or application have been fulfilled. [ISO/IEC/IEEE 24765:2010(E) edited]
- **Verification.**
  - The process of evaluating a system or component to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase.
  - Formal proof of program correctness (e.g., requirements, design, implementation reviews, system tests). [ISO/IEC/IEEE 24765:2010(E) edited]

3.2 Acronyms

API Application Programming Interfaces

ANL Argonne National Laboratory

ARMA Auto-Regressive Moving Average

DOE Department of Energy

FMI Functional Mock-up Interface

FMU Functional Mock-up Unit

HERON Heuristic Energy Resource Optimization Network

IES Integrated Energy Systems

INL Idaho National Laboratory

NHES Nuclear-Renewable Hybrid Energy Systems

IT Information Technology

ORNL Oak Ridge National Laboratory

M&O Maintenance and Operations

NQA Nuclear Quality Assurance

POSIX Portable Operating System Interface

QA Quality Assurance

RAVEN Risk Analysis and Virtual ENviroment

SDD System Design Description

TEAL Tool for Economic Analysis

TRANSFORM Transient Simulation Framework of Reconfigurable Modules

XML eXtensible Markup Language

3.3 System Operations

3.3.1 Human System Integration Requirements

The command line interface shall support the ability to toggle any supported coloring schemes on or off pursuant to section 508 of the Rehabilitation Act of 1973.

3.3.2 Maintainability

- The latest working version (defined as the version that passes all tests in the current regression test suite) shall be publicly available at all times through the repository host provider.
- Flaws identified in the system shall be reported and tracked in a ticket or issue based system. The technical lead or any COB member will determine the severity and priority of all reported issues. The technical lead will assign resources at his or her discretion to resolve identified issues.
- The software maintainers will entertain all proposed changes to the system in a timely manner (within two business days).
- The FORCE framework in its entirety is made publicly available under the Apache version 2.0 license.

3.3.3 Human System Integration Requirements

The regression test suite will cover at least 80% of all models at all times. The results of the regression tests will be stored in the Continuous Integration System.

3.4 Information Management

The FORCE framework in its entirety is made publicly available on an appropriate repository hosting site (e.g. GitHub). Backups and security services will be provided by the hosting service.

4 Verification

The regression test suite shall employ several verification tests of the correct mechanical executions of the models and workflows reported in this repository.

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