

Los Alamos National Lab Electrolyzer Installation

Cathy Grégoire Padró
Project Leader, Hydrogen Systems
Institute for Hydrogen and Fuel Cell Research

This is **NOT** an Electrolyzer Research Project: we require a reliable supply of hydrogen for testing innovative fuel cell and cell stack designs

The Project

- Identify the need
- Evaluate the options
- Purchase the equipment
- Install the unit
- Shake down and start up the system
- Operate normally

Note: this simple, logical process rarely applies on the Planet Earth

Identify the Need

- How much hydrogen?
- What is the required delivery rate?
- How many customers/labs will be connected?
- How much variability is there in demand?
- What purity is required/expected?
- What on-stream reliability (i.e., 24/7/365) is required?
- Is there an expectation of future growth in demand?
- Does the system meet Lab security and safety criteria?

Note: Security and safety at NNSA labs is paramount – cost is generally a secondary consideration at the Lab

Evaluate the Options

- Delivery of hydrogen in tube trailer (“batch” approach)
 - Security issues related to hydrogen tube trailer on Lab property
 - Cost and frequency of tube trailer delivery
- Installation of one large electrolyzer (“central” approach)
 - Flexibility to respond to large swings in demand
 - Reliability is fairly well-established
- Installation of multiple small electrolyzers in a number of labs (“modular” approach)
 - Maintenance and inspection cost is multiplied
 - Careful balancing of individual lab demands
 - Less flexibility to respond to future expansion

Purchase the Equipment

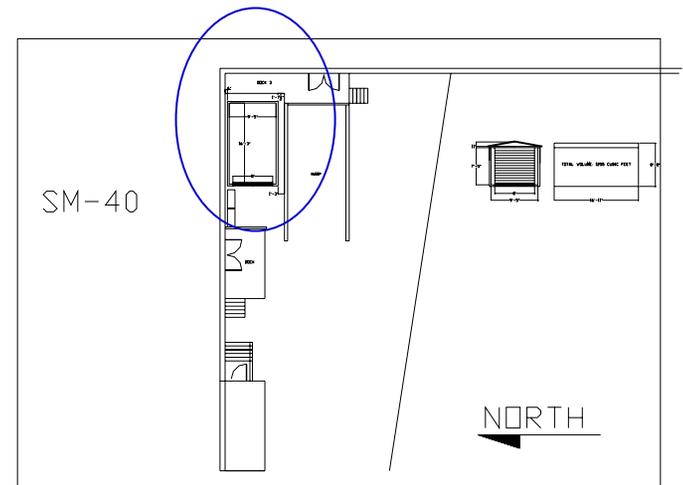
- Spec unit to meet desired output and required purity, reliability, etc.
- Obtain vendor quotes
- Compare vendor quotes
- Place order
- Wait
- Wait some more
- Receive unit



Install the Unit

Step 1: Location

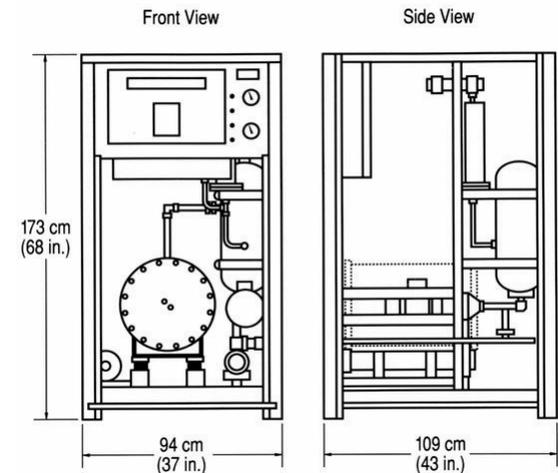
- Identify the preferred location and a few options (don't wait until unit is delivered)
- Assess the feasibility of installing, maintaining, and operating the unit in each location
 - Code issues
 - OSHA issues
 - Availability/access to utilities, drains, egress, etc.
 - Climate control, ventilation, vents, etc.
- Select best option
- Change your mind
- Discuss some more
- Make a final location selection



Install the Unit

Step 2a: Design

- 30% Design
 - Location drawing (might not be to scale)
 - Calculations and specifications
 - Utility requirements
 - Safety systems
 - HVAC
- Long-lead items ordered (i.e., chiller, specialty steels/piping)
- Permitting process initiated
 - Excavation
 - Electrical upgrades



Install the Unit

Step 2b: Design

- 60% Design
 - Location drawing (generally to scale)
 - Refined calculations and specifications
 - Utility requirements
 - Safety systems
 - HVAC
- Location walk-around
 - Issues with existing operations or adjacent uses (i.e., noise, access, egress)
 - Modify layout as required

Install the Unit

Step 2c: Design

- 90% Design
 - Location drawing (to scale), incorporating any changes made as a result of the walk-around
 - Final calculations and specifications
 - Utility requirements
 - Safety systems
 - HVAC
- Initiate development of Project Management Plan
 - On-site construction firm to perform all construction or modification of existing facilities and utilities
 - Initial cost estimate for installation (labor & materials)
 - Preliminary schedule

Install the Unit

Step 2d: Design

- 100% Design
 - Location drawing (to scale), stamped “final”
- Project Management Plan
 - Definitive cost estimate and cost-tracking plan
 - Detailed schedule
- Integrated Work Document review
 - “Task → Hazard → Control → Training”
- “Authorization to Proceed”

Install the Unit

Step 3: Construction

- Construction starts June 14th
 - Excavation and concrete work
 - Electrical work, including transformer
 - Structural work
 - Installation of fan, chiller, ducting, vents
 - Installation of electrolyzer
- Testing
 - Hydrogen lines
 - Mechanical systems
 - Electrical systems
- As-builts for field finish
- Construction close-out

Shake Down and Start Up

- Electrolyzer vendor on site



Operate Normally