

Control Centre Energy Freedom Project

Status update - part 4

2017-07-30 Milestone

A Climate Action Progress Report

By

Art Hunter



WE'RE IN THE RACE OF OUR
LIFETIME



to set the course for the planet, and all future generations

Project Overview

- Homes and personal transportation have dynamic requirements in delivering value to their users. Effective energy management requires a systems approach that considers occupant behaviour, structural envelope and the technical performance of the installed energy management equipment. Managing change in these three areas is the project challenge using technology developments to:
 - achieve energy independence from existing energy infrastructure,
 - increase in survivability during the ravages of climate change
 - delivery of cost savings by improving energy efficiency using a wide range of products and technologies.

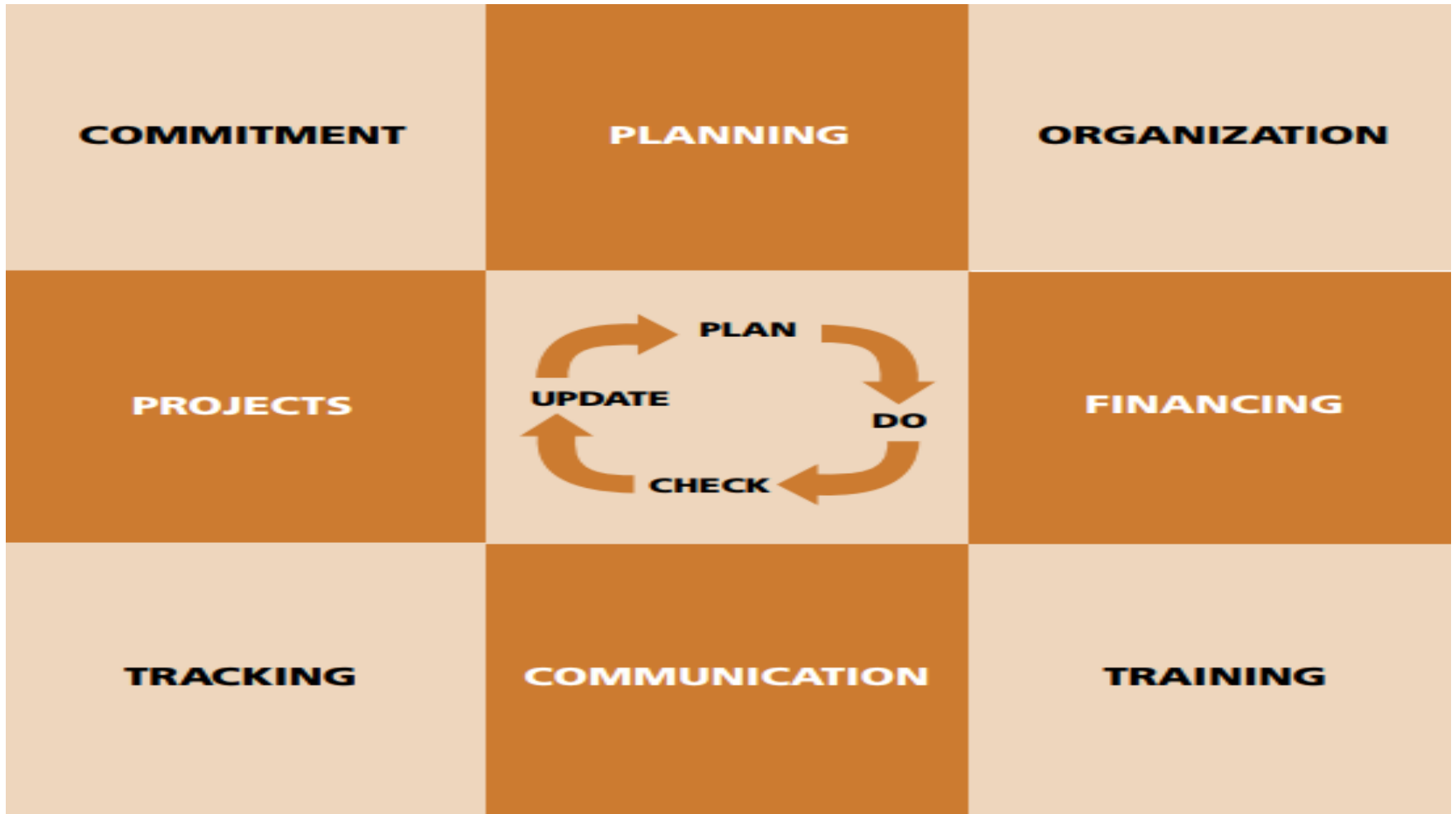
Status Report #4 -- Introduction

- On 18 July 2017, the Energy Freedom Project achieved a significant milestone.
 - Verification of the manual control of home power switching.
 - Display of the state of energy flow.
 - Display of the voltage, current, power and energy to and through major project subsystems.

Project Guidelines

- How do we make alternative energy affordable?
- How do we increase efficiency in energy use?
- How do we determine efficiency best practices?
- How do we store energy and in what form?
- How do we regulate energy use in normal and survival modes?
- What are the Action Categories guiding Development?

Action Categories



Video

- A brief 3.5 minute video of the Control Room build status is shown on https://www.dropbox.com/s/7w9zigb7wc7b6s4/20170720_124246.mp4?dl=0
- Project furniture was designed and built in-house and a room in the home basement was repurposed as the project Control Room

Workstation in April 2017

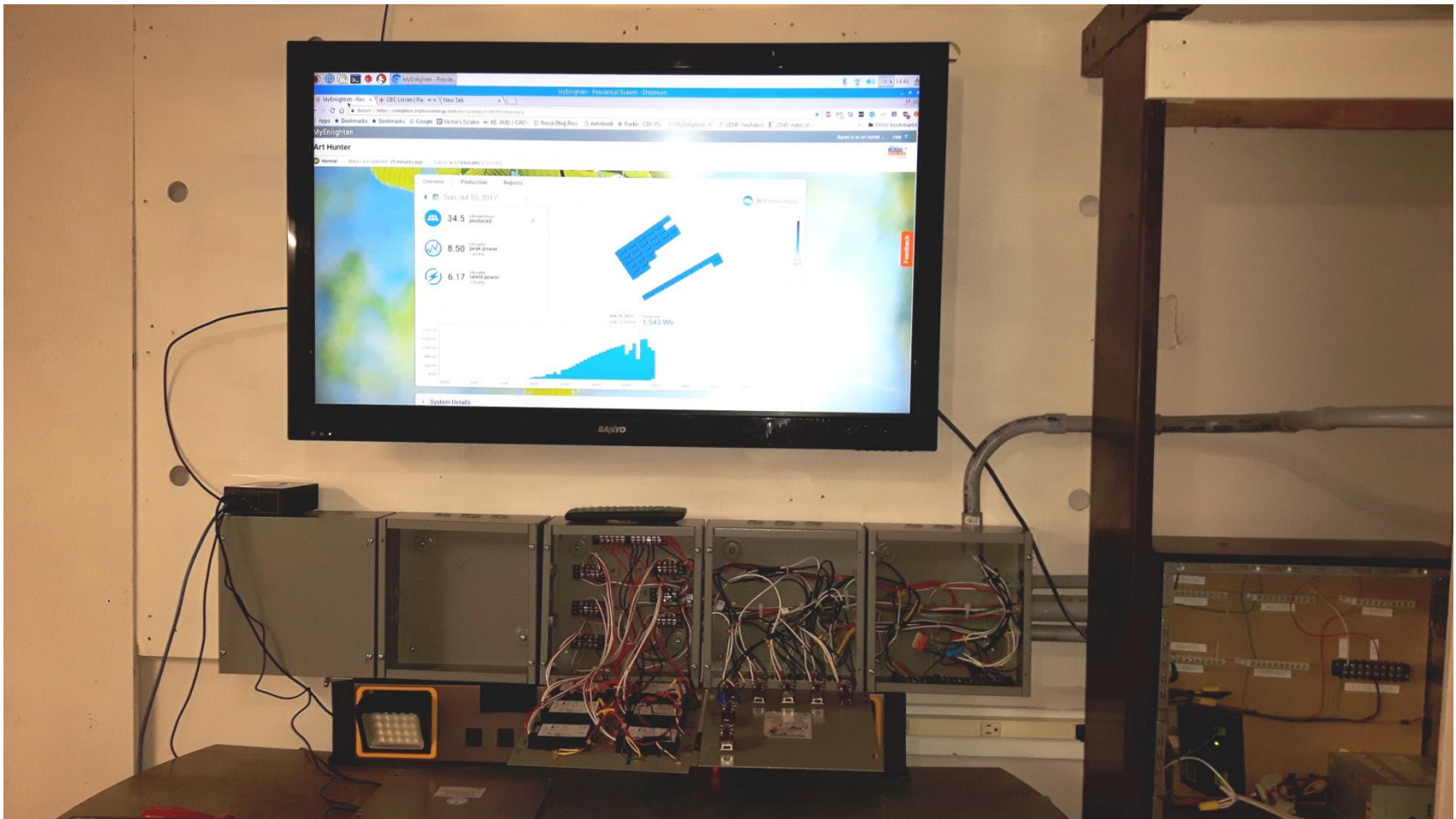


Overview of Workstation

- The layout of the displays and controls.
 - The 43" monitor dominates
 - Five display boxes are immediately below
 - The desk for keyboard and mouse are shown
 - Between the display boxes and table are lights and power plugs.
 - To the right is the main equipment rack

Main Workstation

July 2017



Contactors

- Five 3PST 240 VAC 100 amp contactors are housed in Box 6 on the equipment rack.
- The house circuit breaker panel is nearby in a separate closet on the right
- These contactors control the energy flow from three supply side sources to the battery and the two demand side circuit breaker buses.

Main 240 VAC contactors

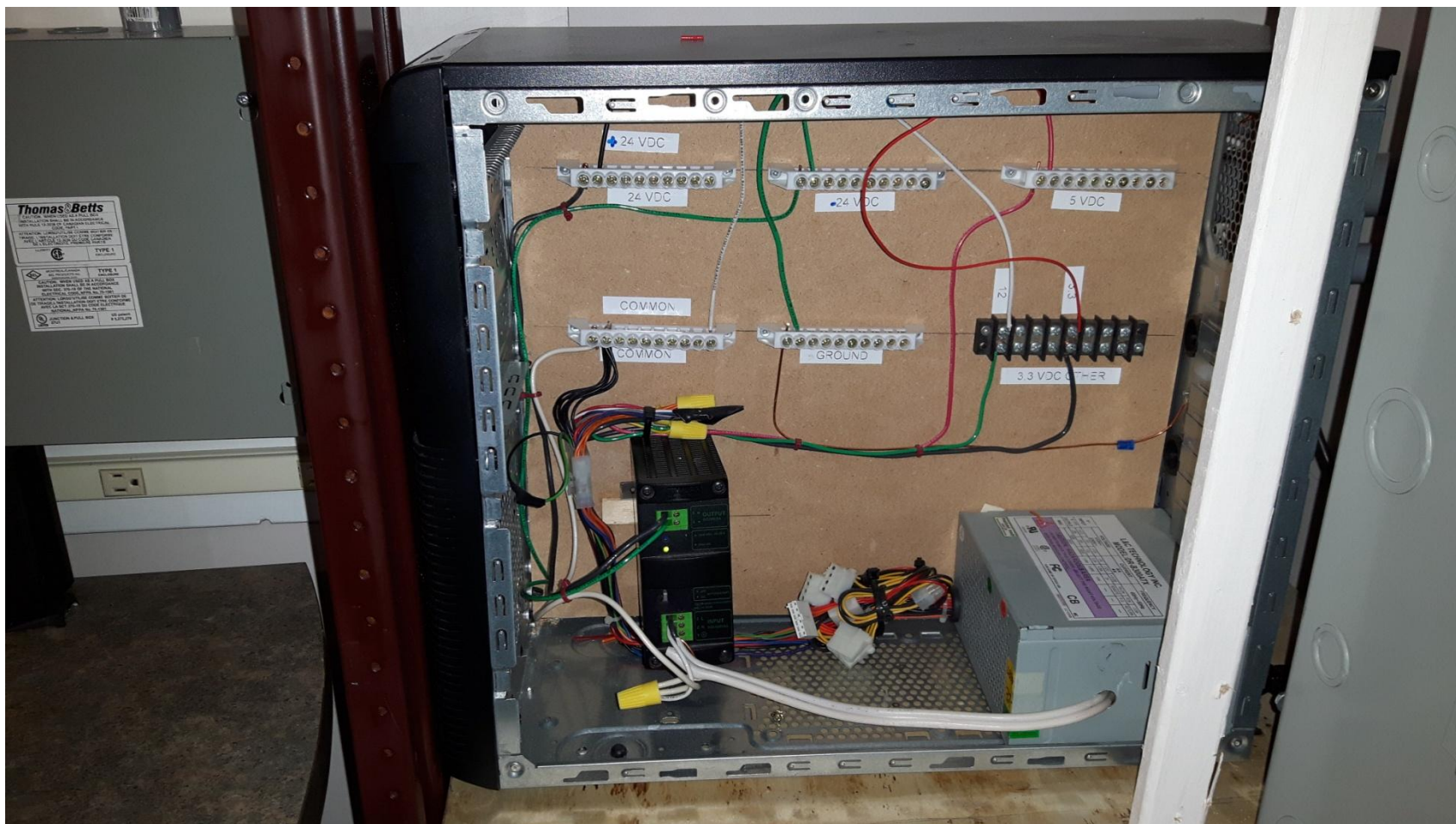
FIVE of them



Power Supply

- System control power is in the equipment rack
 - 24 VDC for the contactor coils
 - 5 VDC for LED lights and other relays
 - 12 VDC and 3.3 VDC for control system use
 - Cooling fan
 - Several spare connectors

Power Supply



Proximity

- The Contactor Box #7 and the power supply occupy space in the main equipment rack.
- The lowest shelf holds the Uninterruptable Power Supply (120 VAC) and surge suppression power protection. This shelf supports the power supply and other critical equipment.

Contactors – Box #7 --and Power Supply on the Equipment Rack



Energy Flow Monitoring

- The central Box #3 contains six energy monitoring meters. Volts, current, power (kW) and energy (kWh)
- Red lines mimic actual cables with the 5 contactors joining major equipment
- Supply side on left – grid, solar, generator
- Demand side on right showing the two circuit breaker buses and the battery
- LED lights show the contactor state connections
- In the picture, contactors 3 and 4 are flowing energy (#3 is solar to battery while #4 is battery to circuit breaker panel)

Energy Flow Meters – Box #3



Manual Switch Panel

- Box #4 holds the manual switches for each contactor coil.
- Main power ON/OFF from the power supply to the contactor coils
- Automatic to manual control switch is still not connected

Switch Box #4



Manual Switching Energy Flows

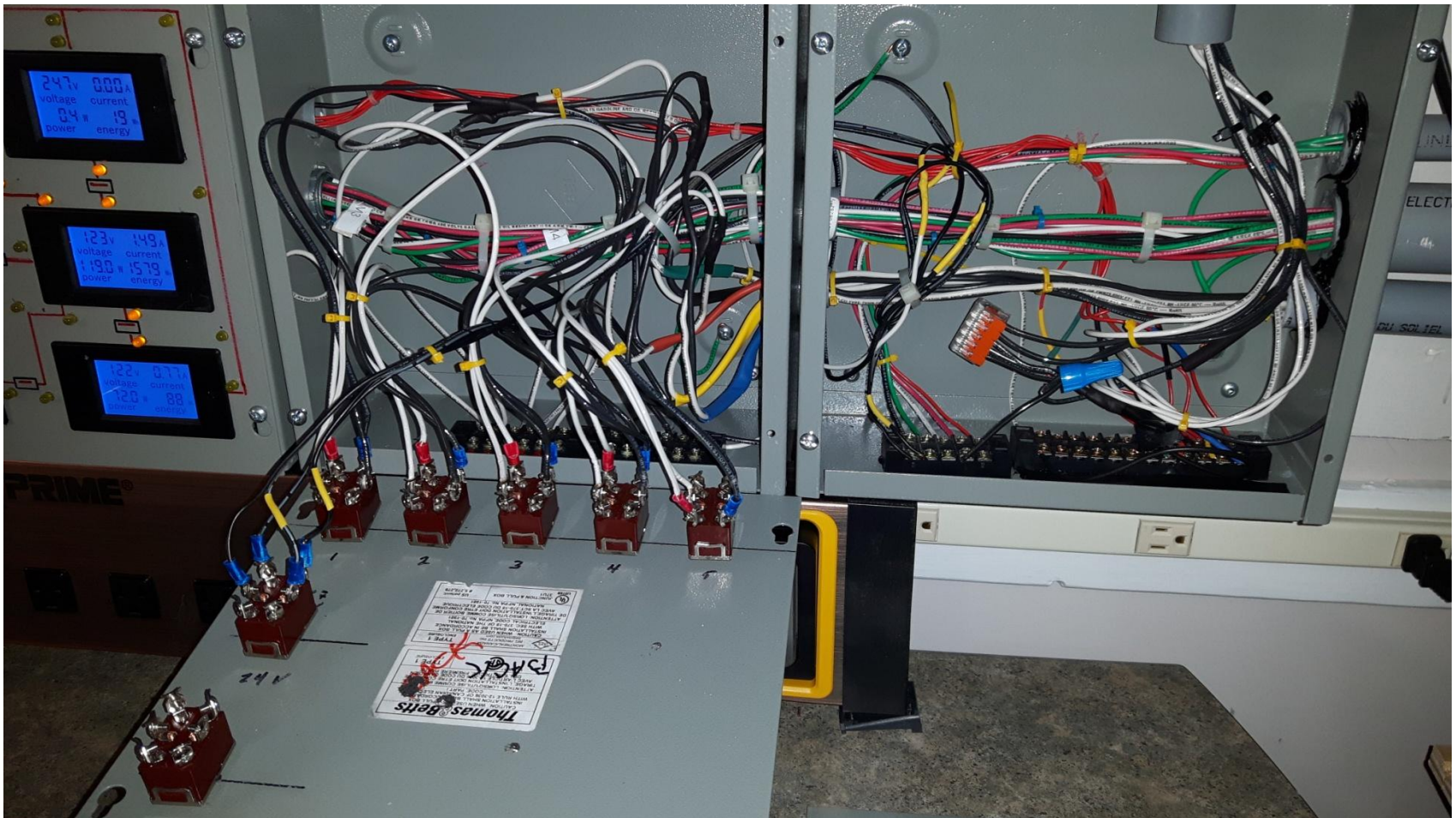


Inside Boxes #4 and 5

- Ease of maintenance has patch connector strips in Boxes #4 and #5
- Manual switches are DPDT for 24 VDC contactor coils and 3.3 VDC for the control system hardware/software to monitor.

Inside the Switch Panel

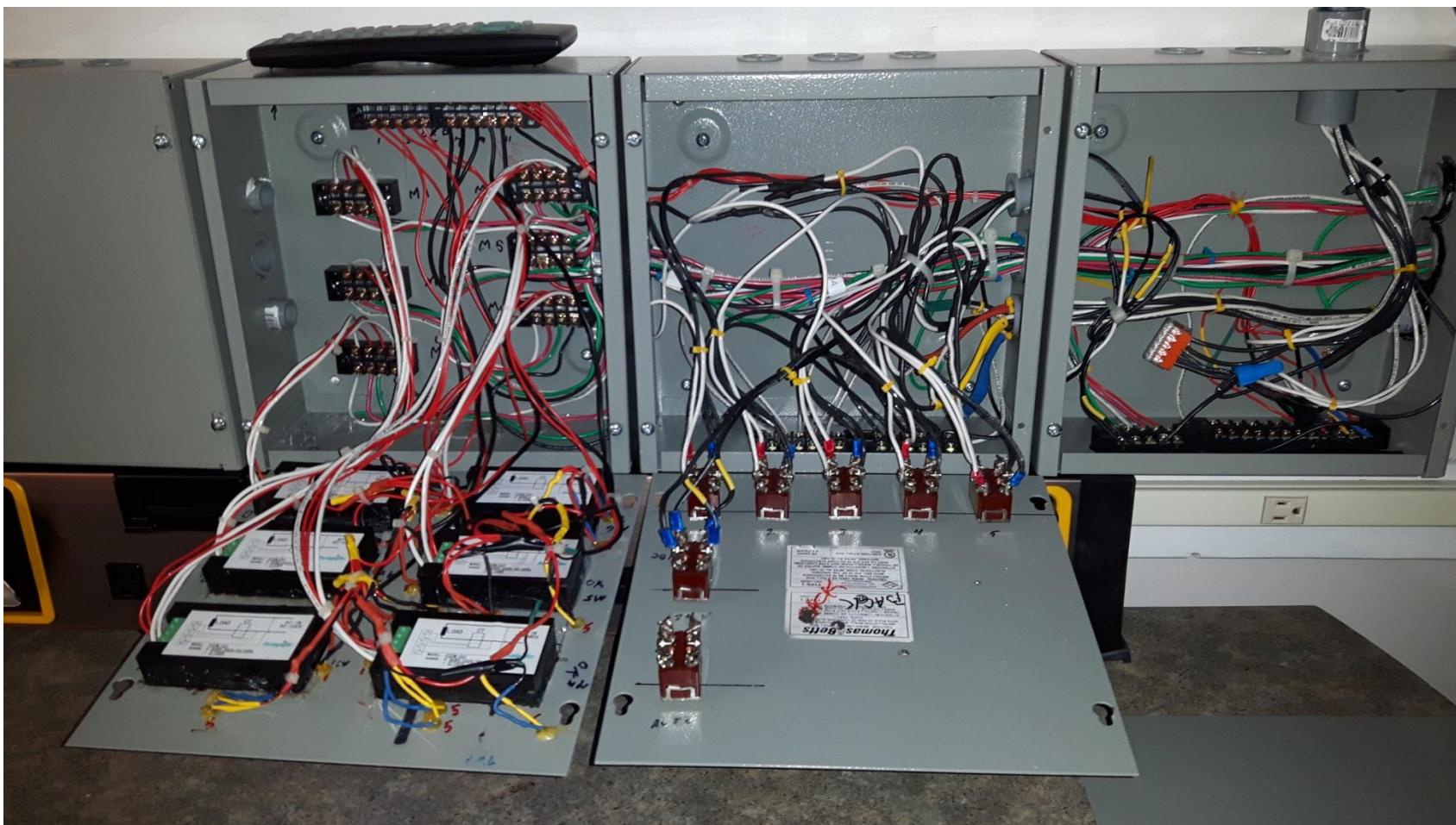
Boxes #4 and #5



Energy Flow Box #3

- It is very busy inside Box #3 but design was for ease of maintenance and future design changes.

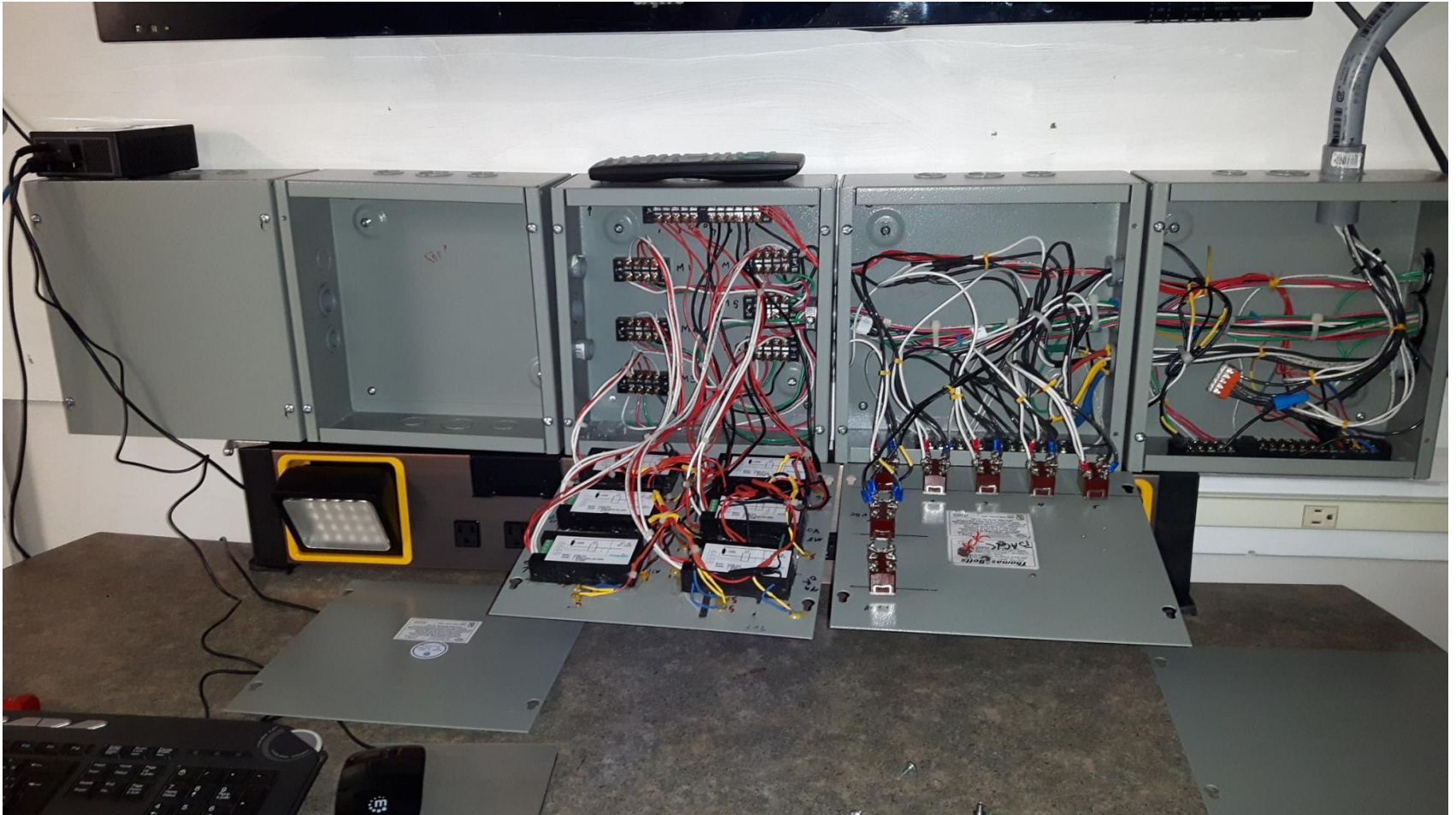
Boxes #3, #4 and #5



Five Boxes

- Illustrating Box #2 is empty
 - For subsystems as they are developed and integrated
- All five boxes are shown
- Workstation table, keyboard and mouse
- Main display monitor remote control on Box #3
- Raspberry Pi3 in PC configuration on Box #1 and connected to the main display monitor

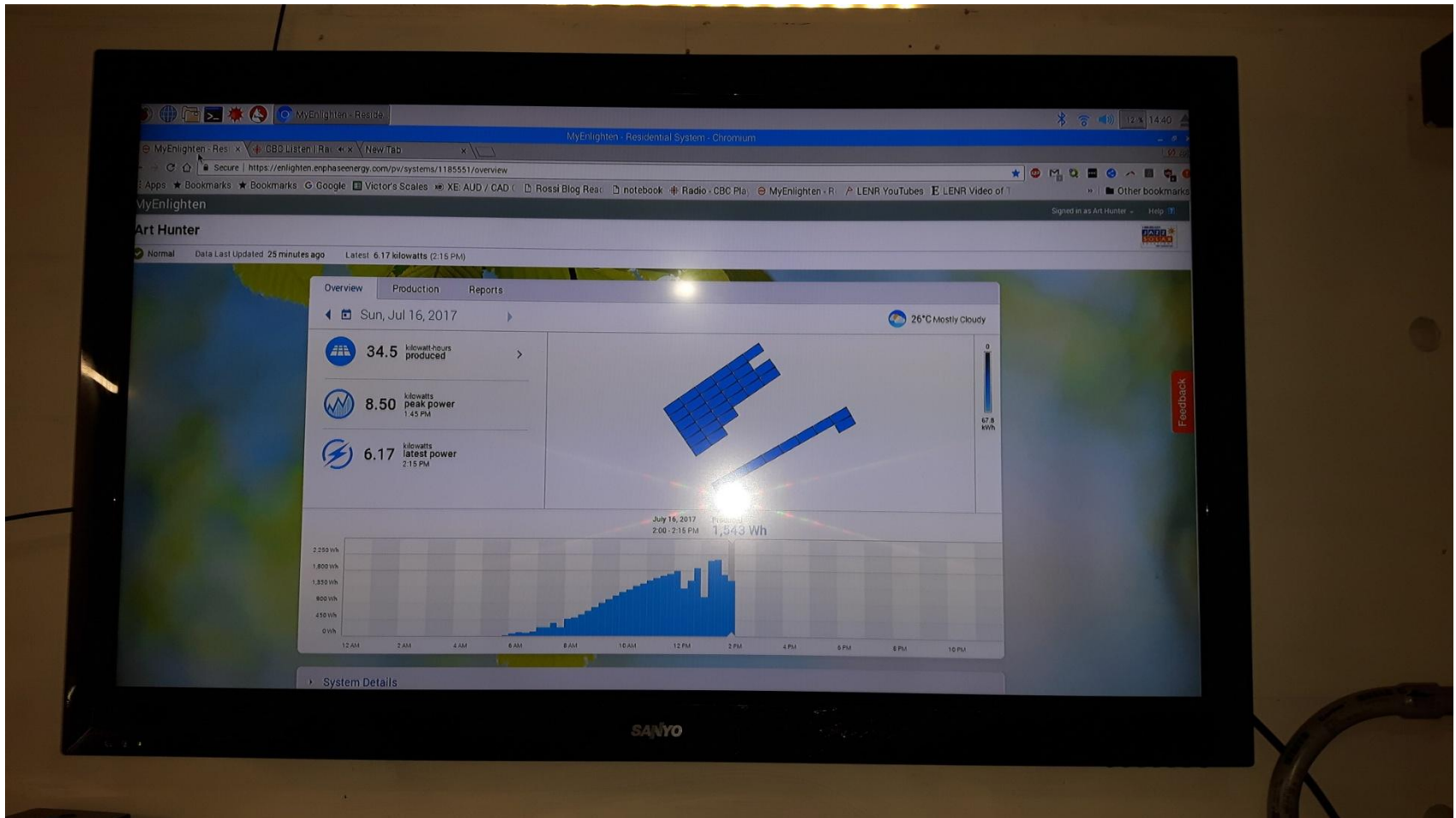
Five Boxes



Main Display Monitor

- Prominent location of main display monitor
- The shown data is the state of energy generation from the 10 kW solar array
 - Every 15 minute vertical bar of generated power on time sequence during the day
 - Artistic representation of solar panel layout
 - Some production data

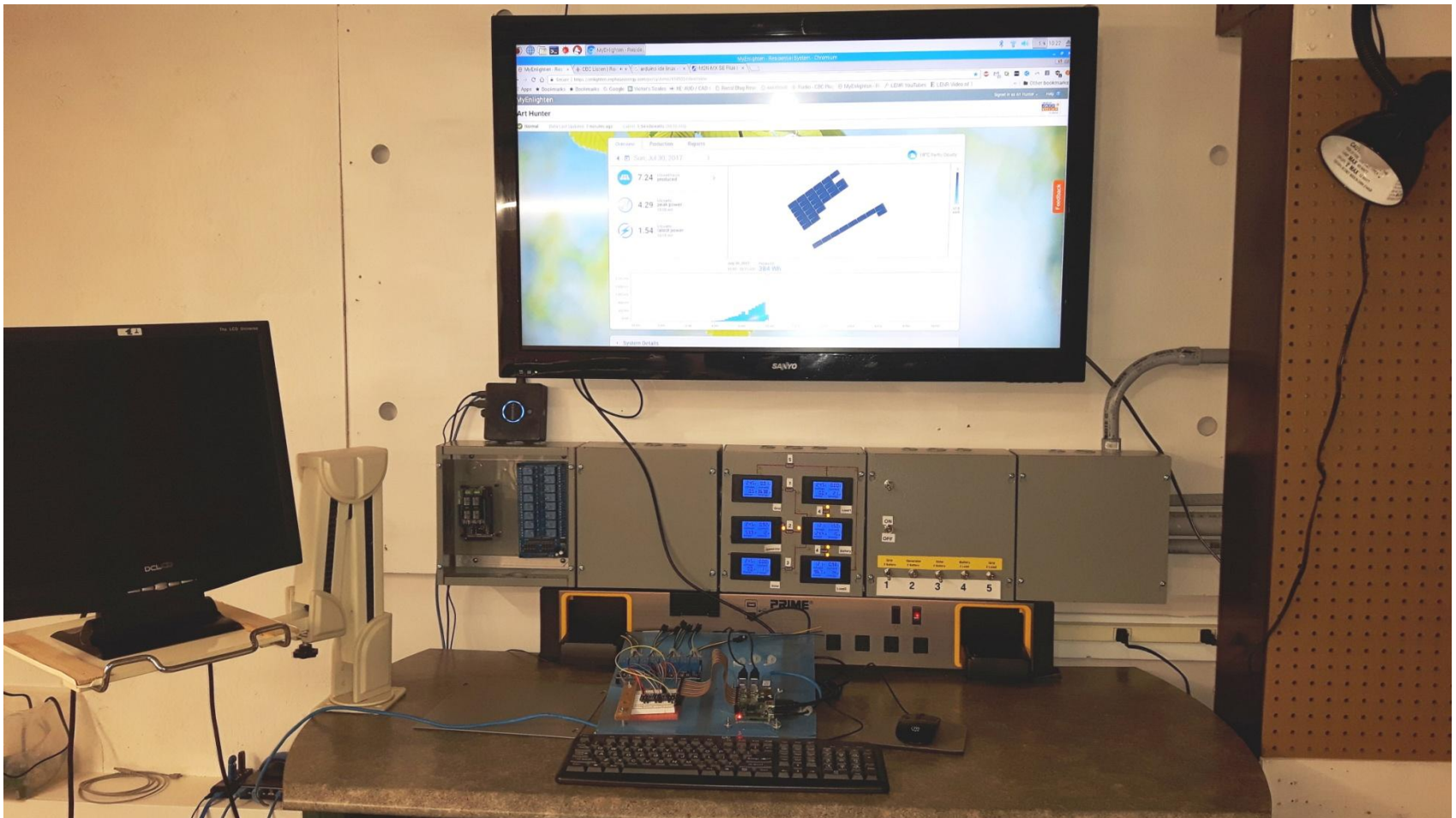
Solar Output on 43" Monitor



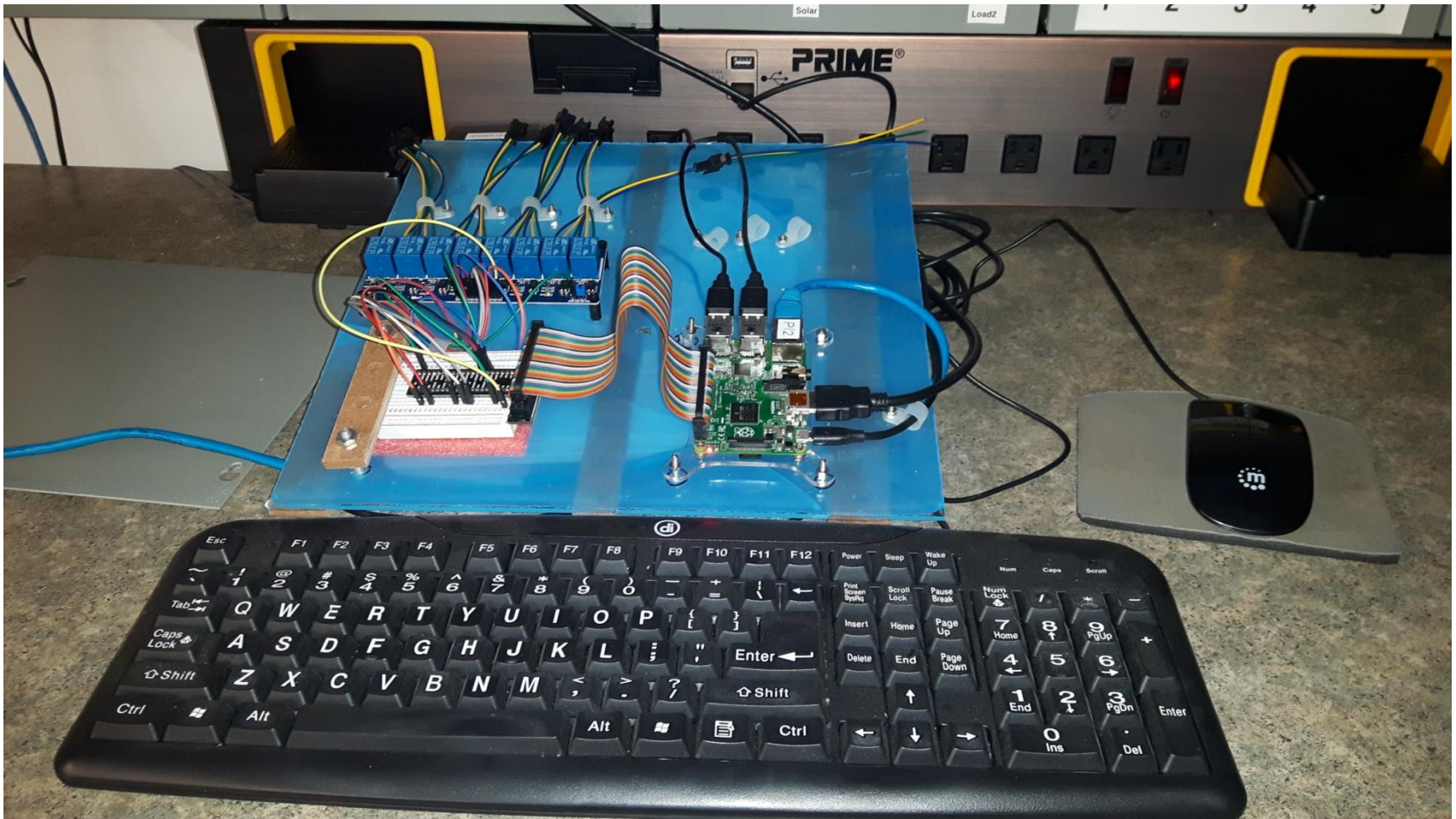
Build on 2017-07-30

- Items of interest
 - Main monitor with live solar power graphic
 - Box 1 with Arduino Mega and 24 relays (Relay Complex).
 - Pi PC on top of box 1 is live on the Internet connected to the main monitor.
 - On desk, live breadboard Pi2 computer controlling 8 relays – test only. To be dismantled.
 - On left is monitor connected to LXLE (Linux) PC located under the table top.

Build on 2017-07-30



Pi 2 Computer During Test



Box #1 – Relay Complex



Next Steps

- Tesla PowerWall 2 battery could be active in August 2017
- Final design of the Ground Source Heat Pump and equipment procurement in August.
- Continue build of Control Room hardware and software including automation of energy flow switching.
- Determine task for Pixcl controller.

Conclusion

- The war against fossil fuels in a Canadian home has made significant progress.
- Business opportunities and development collaborations are being sought.
- “What have you done to reduce your carbon footprint?” is an easy question to answer.
- Further progress status reports shall be issued at completion of significant milestones.