

# Training the Next Generation of Commercial Building Technology Workers

Today, large commercial buildings use sophisticated building automation systems (BASs) to manage a wide and varied range of building equipment. While the capabilities of BASs have increased over time, many buildings still do not fully use their capabilities and are not properly commissioned, operated or maintained, which leads to inefficient operation, increased energy use, and reduced lifetimes of the equipment. Tuning BASs (retro-commissioning), much like tuning automobiles periodically, ensures maximum building energy efficiency and the comfort of building occupants. A poorly tuned system can maintain comfortable condition but at a higher energy cost to overcome inefficiencies.

Small to medium-sized commercial building (less than 50,000 sf) typically lack BASs, therefore and a more difficult challenge in avoiding operational problems. The heating, ventilation and air conditioning equipment, in these buildings, is controlled by a thermostat and other systems (lights and plugs) have no automatic controls.

Retro-commissioning (RCx) can improve the building efficiency and reduced energy waste. However, RCx has been slow to penetrate the market, demonstrated by the small percentage of existing commercial buildings that have been retro-commissioned. In the cases where RCx studies have been completed, implementation of suggested actions to improve building performance and efficiency has been somewhat limited. The advent of the Leadership in Energy Efficient Design (LEED) for existing buildings has promoted commissioning of existing commercial buildings, and yet the fraction of all buildings improved in this way still remains small.

There are a number of reasons why RCx has not penetrated the commercial building market, including: 1) RCx is perceived as too expensive (\$0.1/sf to \$0.6/sf) and 2) RCx measures are perceived to not persist beyond few months. Even if these two major perceptions are overcome, lack of sufficient trained workforce to will make it difficult for a wide spread use of RCx in buildings. So, for RCx to penetrate more broadly two major breakthroughs are needed: 1) development of a systematic low-cost RCx approach for both large and small commercial buildings to identify many operational problems (low-cost/low-cost) and 2) a significant increase in RCx workforce trained the new low cost RCx approach.

One of the major goals of the President's Plan on Better Buildings is aimed at addressing the need to provide workforce training in energy auditing and building operations:

**“Training the next generation of commercial building technology workers:** Using existing authorities, the Administration is currently working to implement a number of reforms, including improving transparency around energy efficiency performance, launching a Building Construction Technology Extension Partnership modeled on the successful Manufacturing Extension Partnership at Commerce, and providing more workforce training in areas such as energy auditing and building operations.”

PNNL/DOE can address the President's Goal by creating regional centers to train the next generation of commercial building technology workers. The following section describes the approach in more detail.

## Approach to Realize President's Goal

To realize the President's goal of training the next generation of commercial building technology workers, a series of activities are needed. Many of these activities can be carried out regionally through creation of Center for Building Operations Excellence (CBOE). CBOE's can be part of technical or community colleges that focus on building operations. There are a number of colleges throughout the U.S. that could potentially be a host to CBOE.

Following major task needed to realize President's Goal:

1. Select CBOEs (this will probably take a minimum of 4 months, if CBOEs are to be competitively selected)
2. Setup CBOEs – **3 months** after the selection (previous task)
3. Develop low-cost RCx (re-tuning) training and train-the-trainer instructions for both large (with BASs) and small (without BASs) commercial buildings
  - a. PNNL has a low-cost RCx (re-tuning) training targeted for large commercial buildings. PNNL is currently working to develop instructional material to go along with the re-tuning training. This material will help in developing additional trainers associated with the CBOEs.
    - i. Drafting of the train-the-trainers instructional material will begin as soon as the decision is made and would take **3 months** to complete.
    - ii. Final version of the train-the-trainer instructional material being after **3 months** for the project start and will take **6 months** to complete.
  - b. Currently, PNNL doesn't have a training that is suited for small- and medium-sized commercial buildings (building without BASs). PNNL can develop a new training for buildings without BASs in 3 to 6 months calendar time. PNNL can also develop instructional material to go along with the training.
    - i. Development of the low-cost RCx training for small- and medium-sized buildings will begin as soon as the decision is made and would take **4 months** to complete.
    - ii. Piloting the training in few buildings will begin after **4 months** of project start and would take **6 months** to complete.

- iii. Preparation of the train-the-trainer material will start **4 months** after the start of the project and would take **6 months** to complete.
4. Transfer low-cost RCx to the CBOEs and provide continued technical support to CBOEs
  - a. PNNL is working with City University of New York to integrate the re-tuning training into a course that CUNY offers. This experience will be valuable as we gear up to transfer the training to CBOEs.
    - i. Transfer will begin as soon as the selection is made and the CBOE are setup, i.e., **6 months** after project initiation and the technical support will continue thru the **duration of the project**.
5. CBOEs to train the next generation of workforce and also train existing RCx workforce in the low-cost RCx approach
  - a. PNNL/DOE to develop guidelines on how CBOEs will train the next generation of workforce , this task will begin as soon as the decision is made and would take **6 months** to complete
  - b. PNNL/DOE to develop guidelines on how CBOEs will train the current generation of workforce through outreach – similar to the re-tuning outreach that PNNL currently doing, this task will begin as soon as the decision is made and would take **6 months** to complete.
6. CBOEs to form local community organizations to promote better building operations – low-cost RCx
  - a. PNNL/DOE in collaboration with CBOEs to develop guidelines on how CBOEs will mobilize local community organizations (BOMA, AEE, ASHRAE, etc) to promote low-cost RCx, this task will begin as soon as the decision is made and would take **6 months** to complete.
7. CBOEs to work with local utilities to promote demand side management programs aimed at Better Building Operations
  - a. PNNL/DOE in collaboration with CBOEs to develop guidelines on how CBOEs will work with local utilities to promote low-cost RCx as a demand side management program – this approach will allow the low-cost RCx to scale in short time period, this task will begin as soon as the decision is made and would take **6 months** to complete.
8. CBOEs to work with local unions to promote low-cost RCx and also to train the union staff in low-cost RCx, this task will begin as soon as the decision is made and would take **6 months** to complete.

- a. PNNL/DOE in collaboration with CBOEs to develop guidelines on how CBOEs will mobilize local unions to promote low-cost RCx, this task will begin as soon as the decision is made and would take **6 months** to complete.
9. Create a process to quantify the benefits provided by CBOEs
- a. PNNL/DOE in collaboration with CBOEs to develop a process to quantify the benefits being provided by CBOEs (energy savings, workforce development, employment, economic development activity, etc ...), this task will begin as soon as the decision is made and would take **6 months** to complete.