

## Executive Summary

The purpose of this report is to investigate the design of the mechanical system for Northeastern Illinois University's new building: El Centro. Upon investigation of the mechanical system and talking with the lead mechanical engineer, it was discovered that the system exceeds the ventilation requirements set forth by ASHRAE. This is because the system was designed using the 2012 Chicago Building Code (CBC), which has stricter mechanical system requirements than the International Mechanical Code (IMC). The IMC is what most building codes across the United States utilize and reference.

The CBC requires a certain amount of airflow provided to each space, regardless of the associated load. 1/3 of this supply air must be outside air. In the past decade or so, with advancements in lighting efficiencies and thermal envelopes, the difference between the CBC required airflow and what is required by the load has increased significantly. For example, certain interior classrooms required twice as much supply air than what was required by the peak load. It is important to note however that the CBC required supply air is allowed to be reduced if the building employs a method of monitoring and controlling CO<sub>2</sub> levels in the space, which El Centro does. However, the ventilation required is calculated by the 1/3 of supply air required as stated previously and cannot be reduced. The CBC required ventilation often exceeds what the IMC and ASHRAE 62.1 require.

A study is conducted in this report to redesign the current mechanical system as if it were to comply with the IMC in lieu of the baseline design (CBC). This led to smaller equipment requirements as well as energy and emission savings. It was discovered that two identical 90 ton RTUs would be sufficient to satisfy the loads associated with the IMC, while 100 ton RTUs would be necessary to satisfy the CBC.

The reduction in the size of the RTUs allowed for there to be a slight reduction in the amount of steel and the amount of electrical wiring. However, these reductions were not as a result of the load reductions associated with the IMC. They were a result of a different design strategy used by choosing packaged RTUs from Carrier that included condensing units, rather than separate condensing units which were in the existing design. Designing to the IMC in lieu of the CBC will most likely not lead to savings in steel or electrical wiring.

Furthermore, there are energy savings associated with complying with the IMC instead of the CBC. A study was also conducted to see the potential energy savings if the entire city of Chicago's mechanical systems were designed to the IMC instead of the CBC. See the table below. It is estimated that this results in removing 1.5 billion lbs. of CO<sub>2</sub>/yr which is equivalent to removing 184,000 cars off the road.

Summary of Savings	Energy Savings		Annual Cost Savings		Emission Savings	
	%	kBtu/year	%	\$/year	%	lbs. CO <sub>2e</sub> /yr
NEIU El Centro	6.70%	232,000	2.90%	\$1,850	2.42%	33,600
City of Chicago	6.70%	10.4 billion	2.90%	\$87 million	2.42%	1.5 billion