303 Energy and Utilities Case Studies

AIA Continuing Education Provider

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Course Description

Energy & Utilities track of the institute offers multiple courses that allow segmented learning about various aspects of energy management and utilities production and distribution. The case study work sessions introduces a practical and real-life situations in energy and utilities department. Course participants work through the situation applying the knowledge that they gained through other coursework. In small groups and then as a class together we engage in discussion regarding the topic at hand.

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Learning Objectives

- Learning Objective 1:
  Discuss practical and real-life situations in energy and utilities departments.
- Learning Objective 2:
  Learn how a work through situations in energy and utility departments.
- Learning Objective 3:
  Learn about various aspects of energy management, utilities production and distribution.
- Learning Objective 4:
  Discuss real life situations encountered on today's campuses.

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Responsibility Centered Management (RCM) for Energy/Utilities

Midwest University is an academic and research institution with 15,000 undergraduate and graduate students.

Facilities department at Midwest U operates a central utility plant to serve its campus buildings. They produce electricity using natural gas for academic, research, student-life, residential, athletics buildings. They also produce steam for heating and research purposes and chilled water to provide air-conditioning and humidity control.

Historically the university has absorbed all the costs associated with utility production & distribution. As state funding for the university has continuously been reduced, the provost is looking for ways to reduce the university budget. Utility costs are second only to personnel costs at Midwest U. To encourage energy conservation by departments and schools to reduce utility costs, the provost is considering a Responsibility Centered Management (RCM) budget model for utility spending.

In this new model all academic and research departments will get their share of the utility budget based on their historical consumption. When a department conserves energy and reduces their utility spending, they get to keep the difference between the allocated budget and the actual spend; but must use their departmental funding if their utility costs rise. Athletics and student-life will have to support themselves for revenue generated by their operations.

The provost has directed the facilities department to provide feedback on the following questions:

Questions:

1) How can we achieve this goal and what does the transition look like?
2) What are the benefits of the model proposed by the provost?
3) What are the challenges with the new RCM model?
4) Are there any long-term ramifications to the RCM model?

Electric Demand Management

Midwest University is an academic and research institution with 15,000 undergraduate and graduate students.

Facilities department at Midwest U operates a central utility plant to serve its campus buildings. They DO NOT generate any electricity on campus. All electricity is purchased from the local municipal provider MuniElectric. University is responsible for distributing this electricity to campus buildings. They also produce steam for heating and research purposes and chilled water to provide air-conditioning and humidity control.

The University pays $0.03 per KWH of electricity that is consumed by the utility plant and the campus buildings. In addition, due to capacity limitations MuniElectric also charges the University $20 per KW of electric demand. The University has a ratchet agreement for electric demand with MuniElectric as follows:

The University must pay higher of the two costs:

a) *75% of their peak demand set during the previous summer (June, July, August, September) or*
b) *Actual used demand.*

A table (Table 1) of University's last year consumption is available for reference. As can be observed from table 1 higher electric demand during summer becomes a large expense for the university during the non-peak months.

To reduce this cost, Midwest U is evaluating using a steam turbine chiller during the hottest days to reduce the peak electric demand. A steam turbine chiller uses minimum electricity during its runtime and relies on a steam turbine to produce chilled water. Since steam is required during the summer season for research, the only cost to run the steam turbine is the variable cost of additional steam. However, the cost to run the steam turbine chiller is $200/hour more than a comparable electric chiller for same amount of cooling. The steam chiller can reduce the electric demand by 2000 KW during the very warm days. Table 2 shows the projected electric demand data with 2000 KW of electric demand reduction from the proposed steam turbine chiller.

Director of Facilities has challenged the Utility Operations Manager to answer the following questions:

Questions:

1) How many hours can the steam turbine chiller be operated for best cost-effective operation?
2) What are the risks associated with steam turbine chiller?
3) Are there any other tools to manage university's electric demand?

Table 1: Demand Data from previous year

Month	Actual Electric Demand (KW)	Ratchet Electric Demand (KW)	Cost for Actual Electric Demand ($)	Cost for Ratchet Electric Demand ($)	Paid to MuniElectric ($)	Extra Cost due to Ratchet ($)
January	8,000	12,000	$160,000	$240,000	$240,000	$80,000
February	8,000	12,000	$160,000	$240,000	$240,000	$80,000
March	8,000	12,000	$160,000	$240,000	$240,000	$80,000
April	8,000	12,000	$160,000	$240,000	$240,000	$80,000
May	8,000	12,000	$160,000	$240,000	$240,000	$80,000
June	16,000	12,000	$320,000	$240,000	$320,000	-
July	16,000	12,000	$320,000	$240,000	$320,000	-
August	16,000	12,000	$320,000	$240,000	$320,000	-
September	16,000	12,000	$320,000	$240,000	$320,000	-
October	8,000	12,000	$160,000	$240,000	$240,000	$80,000
November	8,000	12,000	$160,000	$240,000	$240,000	$80,000
December	8,000	12,000	$160,000	$240,000	$240,000	$80,000
				Total	$3,200,000	$640,000

Table 2: Projected Demand Data with a steam turbine chiller

Month	Actual Electric Demand (KW)	Ratchet Electric Demand (KW)	Cost for Actual Electric Demand ($)	Cost for Ratchet Electric Demand ($)	Paid to MuniElectric ($)	Extra Cost due to Ratchet ($)
January	8,000	10,500	$160,000	$210,000	$210,000	$50,000
February	8,000	10,500	$160,000	$210,000	$210,000	$50,000
March	8,000	10,500	$160,000	$210,000	$210,000	$50,000
April	8,000	10,500	$160,000	$210,000	$210,000	$50,000
May	8,000	10,500	$160,000	$210,000	$210,000	$50,000
June	14,000	10,500	$280,000	$210,000	$280,000	-
July	14,000	10,500	$280,000	$210,000	$280,000	-
August	14,000	10,500	$280,000	$210,000	$280,000	-
September	14,000	10,500	$280,000	$210,000	$280,000	-
October	8,000	10,500	$160,000	$210,000	$210,000	$50,000
November	8,000	10,500	$160,000	$210,000	$210,000	$50,000
December	8,000	10,500	$160,000	$210,000	$210,000	$50,000
				Total	$2,800,000	$400,000

This concludes The American Institute of Architects Continuing Education Systems Course

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