WARREN ENERGY ENGINEERING, LLC

Case Study: Evaluating Demand Savings from Chilled Water Thermal Energy Storage

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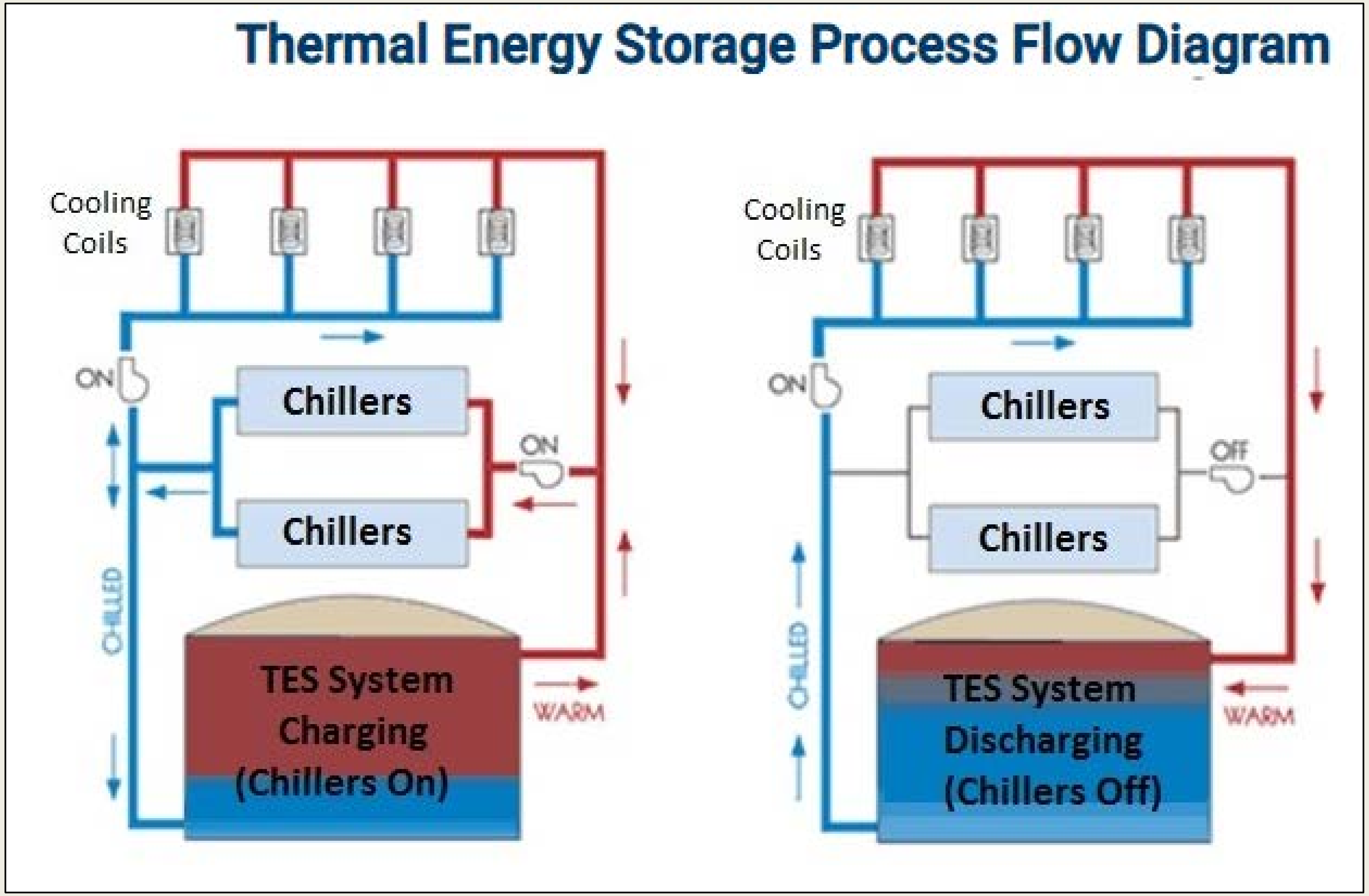
IEPEC Denver

Thermal Energy Storage – How it Works:



Key Considerations

- Focus here only on demand (kW) savings
- Goal: reduce demand (kW) by turning off chiller plant equipment
- 2 main types: sensible (chilled water), latent (“ice”)
- Systems cannot respond instantly - need to plan for operation
- How does program define demand?
- Not just demand of plant equipment, but how they operate

Savings Formulation – Built-up Model

kWsave = kWplant (baseline, peak) - kWplant (post, peak),

kWplant (baseline, peak) = Σi(kWchillerbase, i) + Σi(kWpumpbase, i) + Σi(kWctbase, i),

*kWchiller = Σi (tons, i * kW/ton, i),*

kWpump = Σi(kWpchwpbase, i) + Σi(kWschwpbase, i) + Σi(kWcwpbase, i);

kWplant (post, peak) = Σi(kWchillerpost, i) + Σi(kWpumppost, i) + Σi(kWctpost, i) - Σi(kWTESpost, i)

- Best source is direct measurement of equipment
- EMS with trending data ideal
- Understand how plant is sequenced

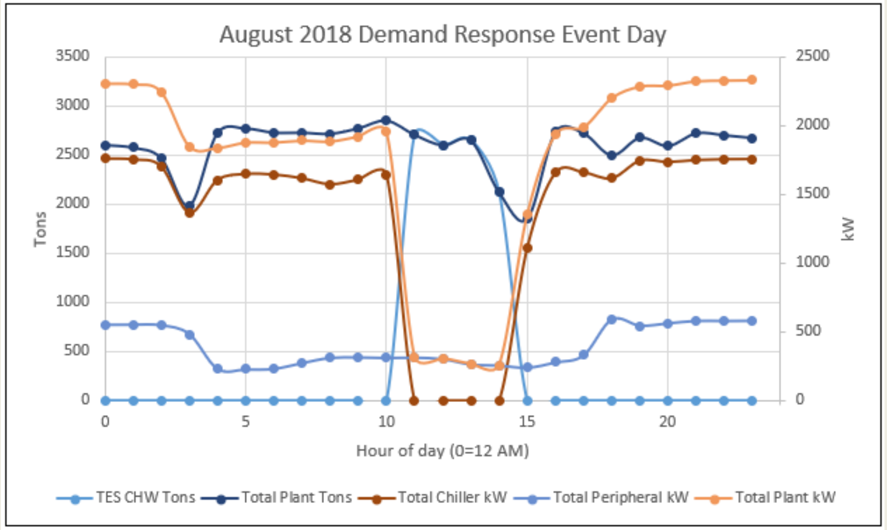
Challenges

Item	Response
Plant Config. & Sequencing	"On the hottest day of the year, what equipment is running?" "What output of chiller #1 do you switch to chiller #2?"
No or bad baseline data	Ask for partial metering May need to use judgements – uncertainties likely
Chiller Efficiency	Code or nominal not the best picture Varies with age, load, etc.
Pump and Fan kW	May be able to use constant values – understand operation For VSD, best to do some metering

Case Study

- Large office complex, ~2,500 tons peak load
- Ice storage system – all chillers off
- No baseline EMS data
- Very limited baseline metering
- Chillers also replaced – could not meter in post
- Peak Period:

2 – 6 PM, M-F, 6/1 – 9/30, when "event" called



Results

Parameter	Baseline Value	Post-Installation Value	Savings
Peak Load (tons)	2,500	2,500	N/A
Chiller kW	1,500	279	1,221
Condenser Water Pump kW	550	31	519
Cooling Tower kW	135	40	95
Total kW	2,185	350	1,835

- 10% less kW savings than predicted
- Some CW system load (small effect)
- Able to determine 1 chiller was running for 15 min during 1 event

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