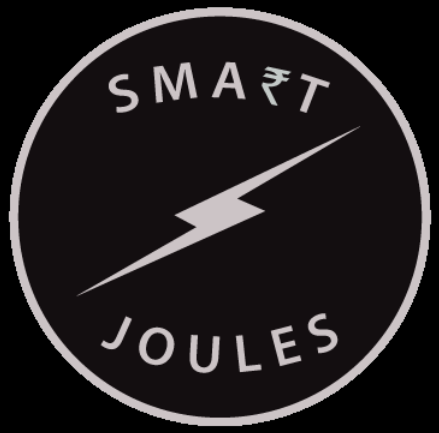
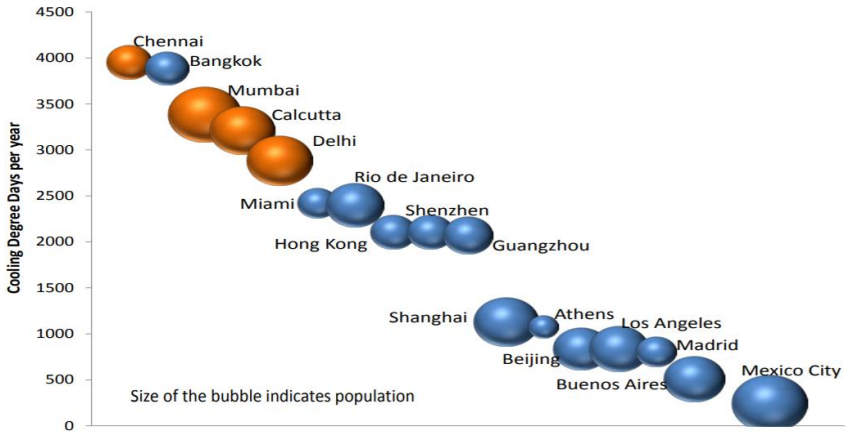


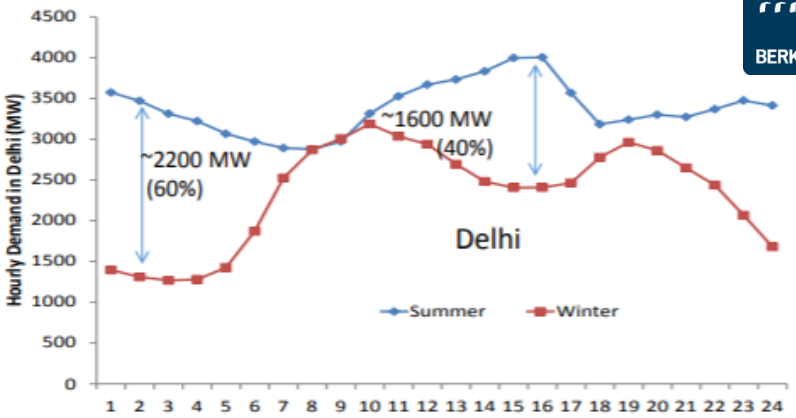
DeJoule: Cost-Effective AI + IoT to Dynamically Optimize Variable Energy Systems

Prepared for: Asia Clean Energy Forum
Manilla, Philippines

June 7th, 2018

Cooling Consumes a Lot of Energy, Especially in Asia



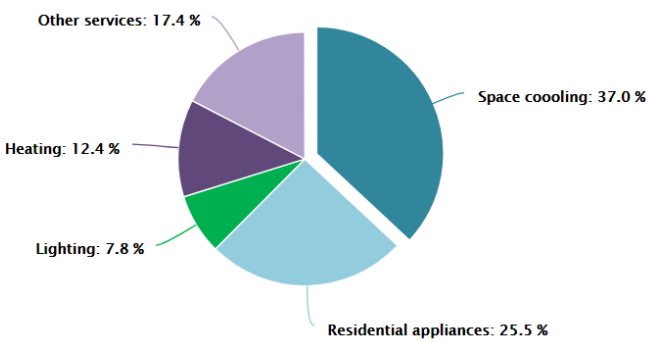


https://static1.squarespace.com/static/58bdaca229687fdb653edbc0/t/595e832d15d5dbeb73ad1a51/1499366198523/ELPPhadkeJune.pdf

Cooling is the fastest growing use of energy in buildings

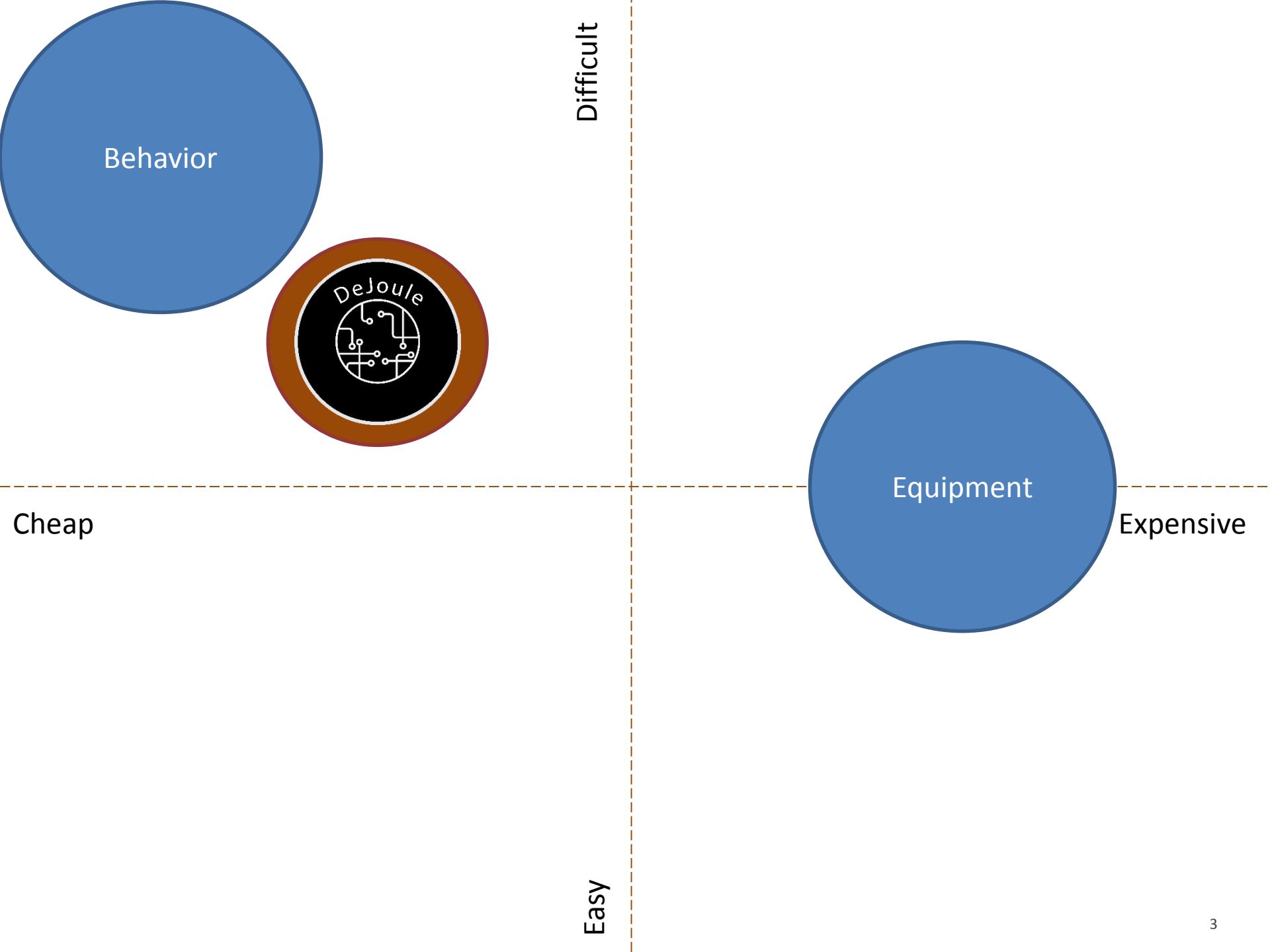
Without action to address energy efficiency, energy demand for space cooling will more than triple by 2050 – consuming as much electricity as all of China and India today.

Share of final electricity demand growth to 2050



International Energy Agency

http://www.iea.org/newsroom/news/2018/may/air-conditioning-use-emerges-as-one-of-the-key-drivers-of-global-electricity-dema.html?utm_content=buffer823c4&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer


Behavior
DeJoule
Difficult
Cheap
Equipment
Expensive
Easy

The AI key to unlock IoT potential

"The powerful **combination of AI and IoT technology** is helping companies avoid unplanned downti**cre** **operating efficiency**, enable new products and services, and enhance risk management."

Cooling is the fastest growing use of energy in buildings

https://www2.deloitte.com/insights/us/en/focus/signals-for-strategists/intelligent-iot-internet-of-things-artificial-intelligence.html

Case: Sant Parmanand Hospital, Delhi

Optimizing Pre-Cooling Times

All OTs Switched on 2 hours Prior to Operations

Operation Theatre #1

Day	Set Point (C)	Time Taken To achieve setpoint
Fri	16	1 Hr 10 m
Sat	16	50 m

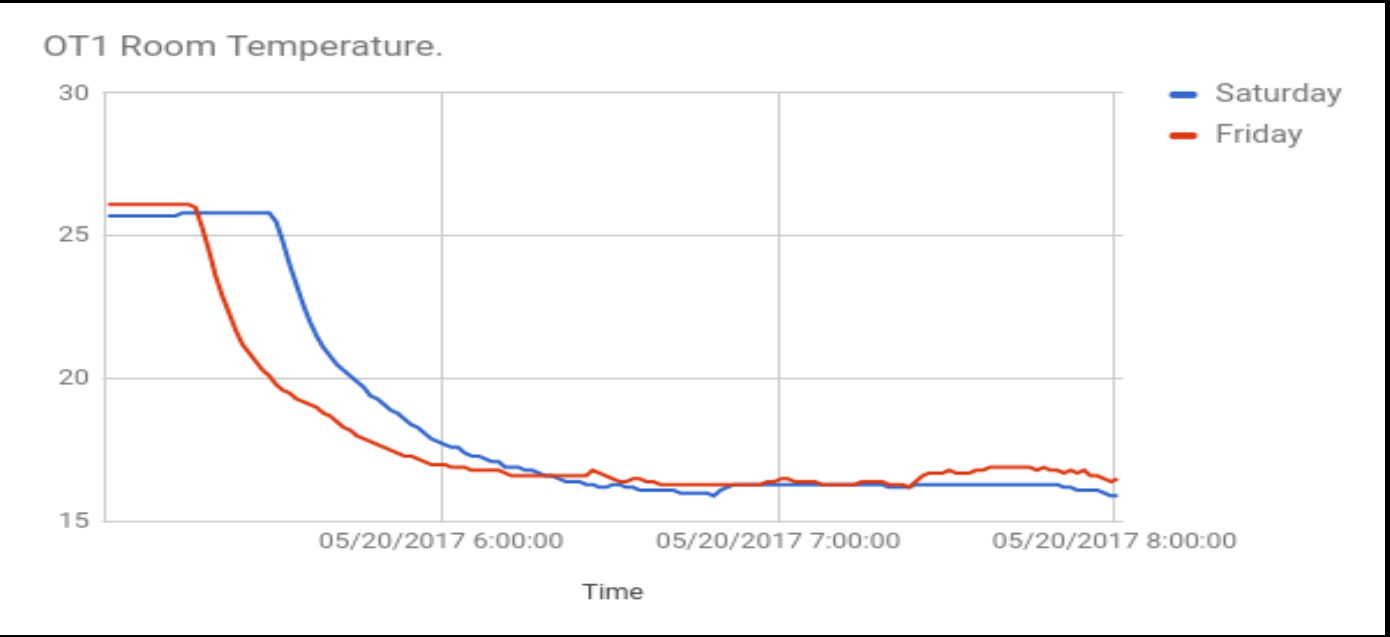
Operation Theatre #2

Day	Set Point (C)	Time Taken To achieve setpoint
Mon	19	1 Hr 57 m
Tue	19	1 Hr 30 m
Wed	19	1 Hr 30 m

Optimizing Temp. Set Points and Start Times

OT1 was pre cooled to ~16°C by 6am while use started at 7am.

Could the temperature have been kept ~20°C until 6:45am?



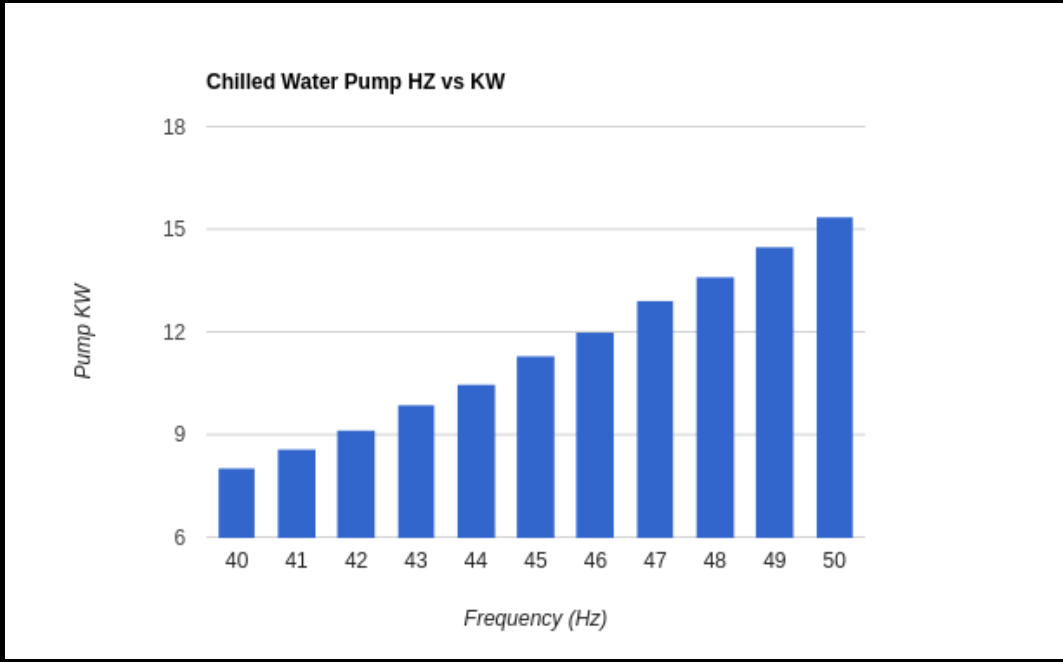
Finding Optimal Chilled Water Set Point

Chiller Setpoint (F)	AHU Water Inlet Temp. (C)	Avg. Supply Air Temp. (C)	Room Temp. Range (C)
44	7.5	11.1	18.6 - 19.6
45	8	11.7	20.0 - 23.0
46	8.3	12.6	20.0 - 23.0
47	9	12.8	21.0 - 24.0

Comfortable Room Temperature With 5-6% Less Energy

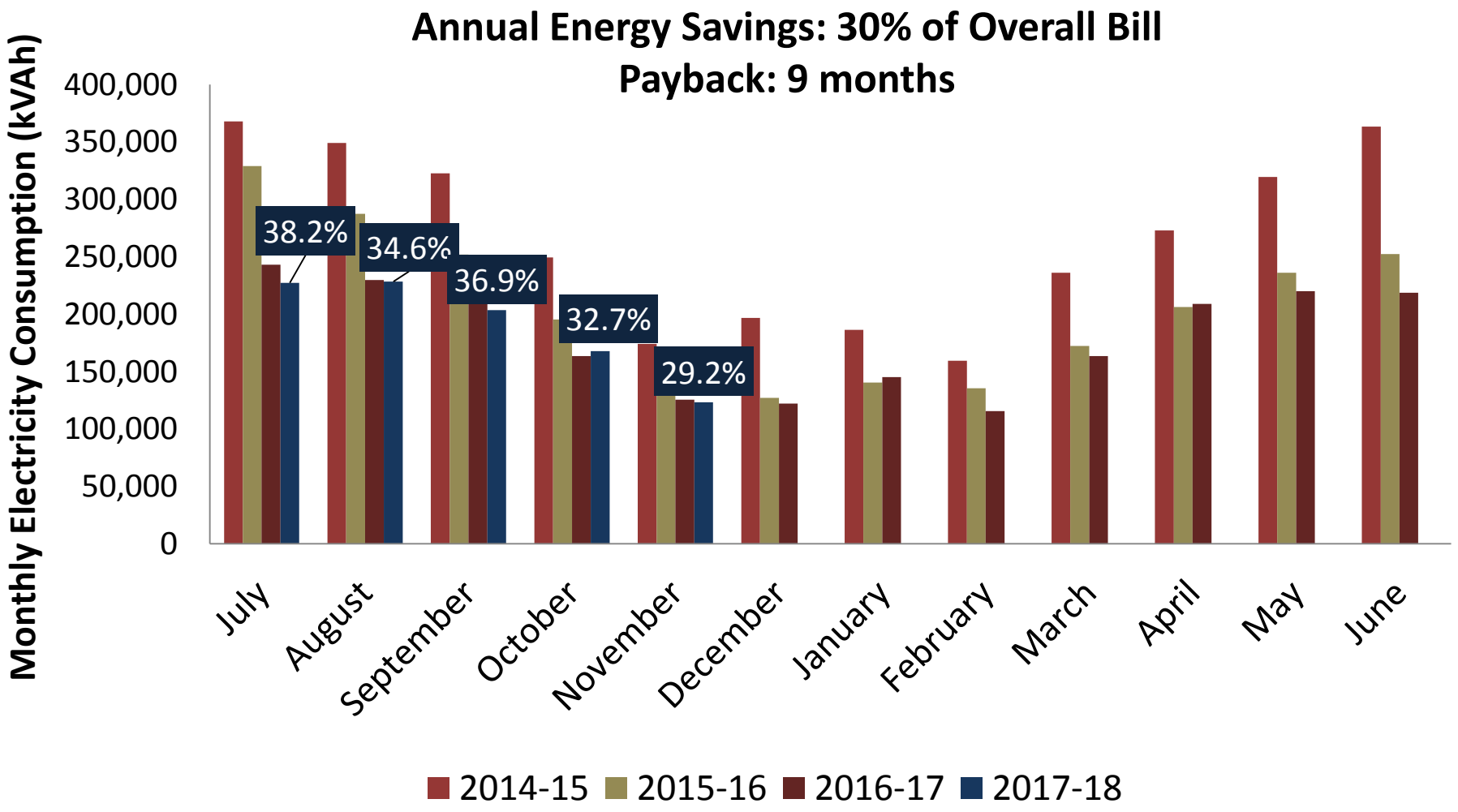
Finding the Right Pumping Combination

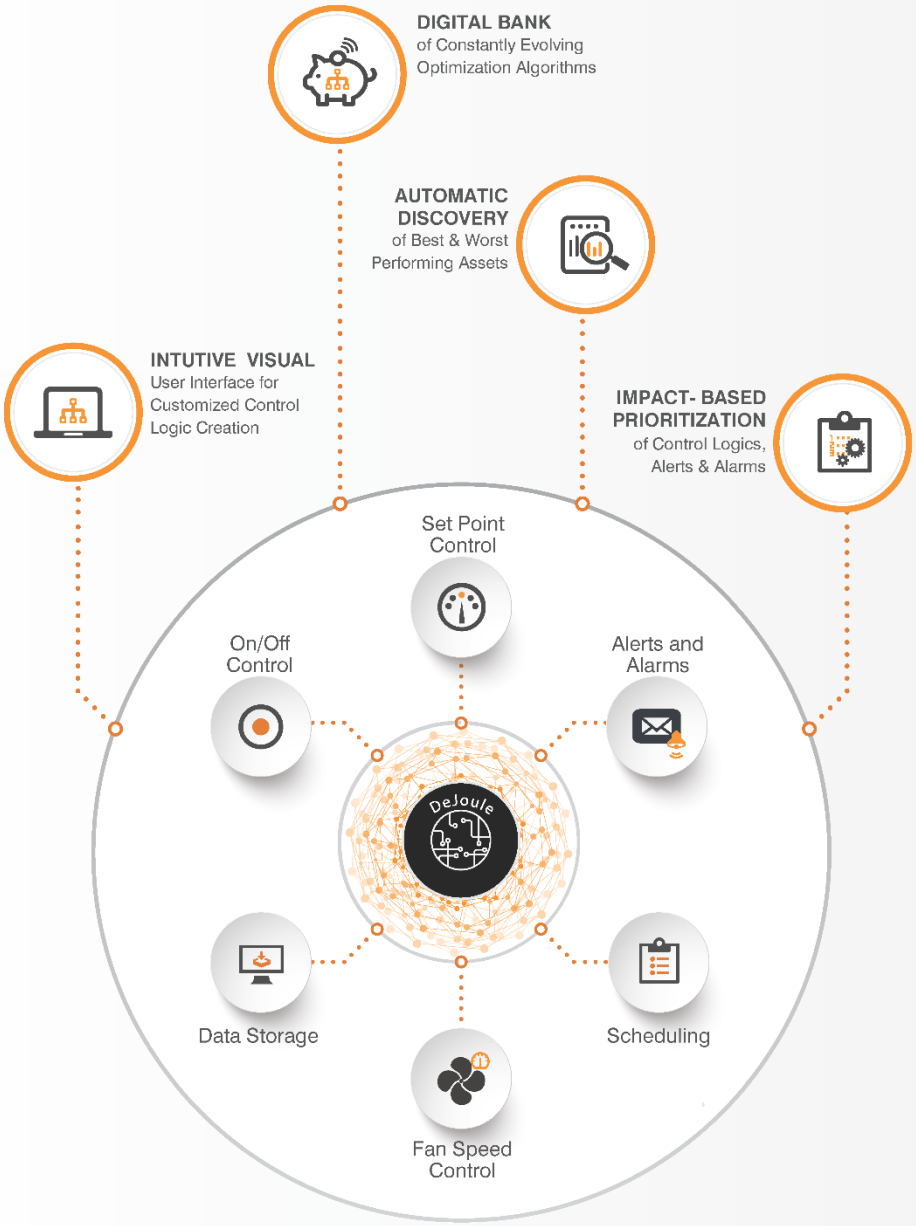
Chilled Water Pump Operations	Frequency	Flow	Total KW
Single Pump	42	454	11
Both Pumps	30 and 33	450	8.6 (4 + 4.6)



6% increase in kW consumption per 1 Hz (2%) rise in VFD frequency

Energy Savings Results





Generic BMS Features + DeJoule's Novelty

Summary

The Question: What is the best combination of Chillers, Pumps, Cooling Towers, Chilled Water Set Points, Valve Positions and Motor Running Speeds to achieve desired comfort?

At any given point of time.

The Solution: **Continuously Find** and **Automatically Deploy** best operating points.

Reliably and Affordably.

Let’s Partner to Revolutionize Cooling.

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