Session Agenda

Load Management to Grid Flexibility – Foundations of building a virtual power plant

Brian Tholl, Fort Collins Utilities

Supporting Southern California's Load Flexibility with Customer Programs

Jillian Nelson, Clean Power Alliance

The Methods are Many, the Concepts are Few...but Growing: Load Management with Batteries, EV Chargers, and More

Stefan Johnson, Holy Cross Energy

04-24-25

Load Management to Grid Flexibility – Foundations of a Virtual Power Plant

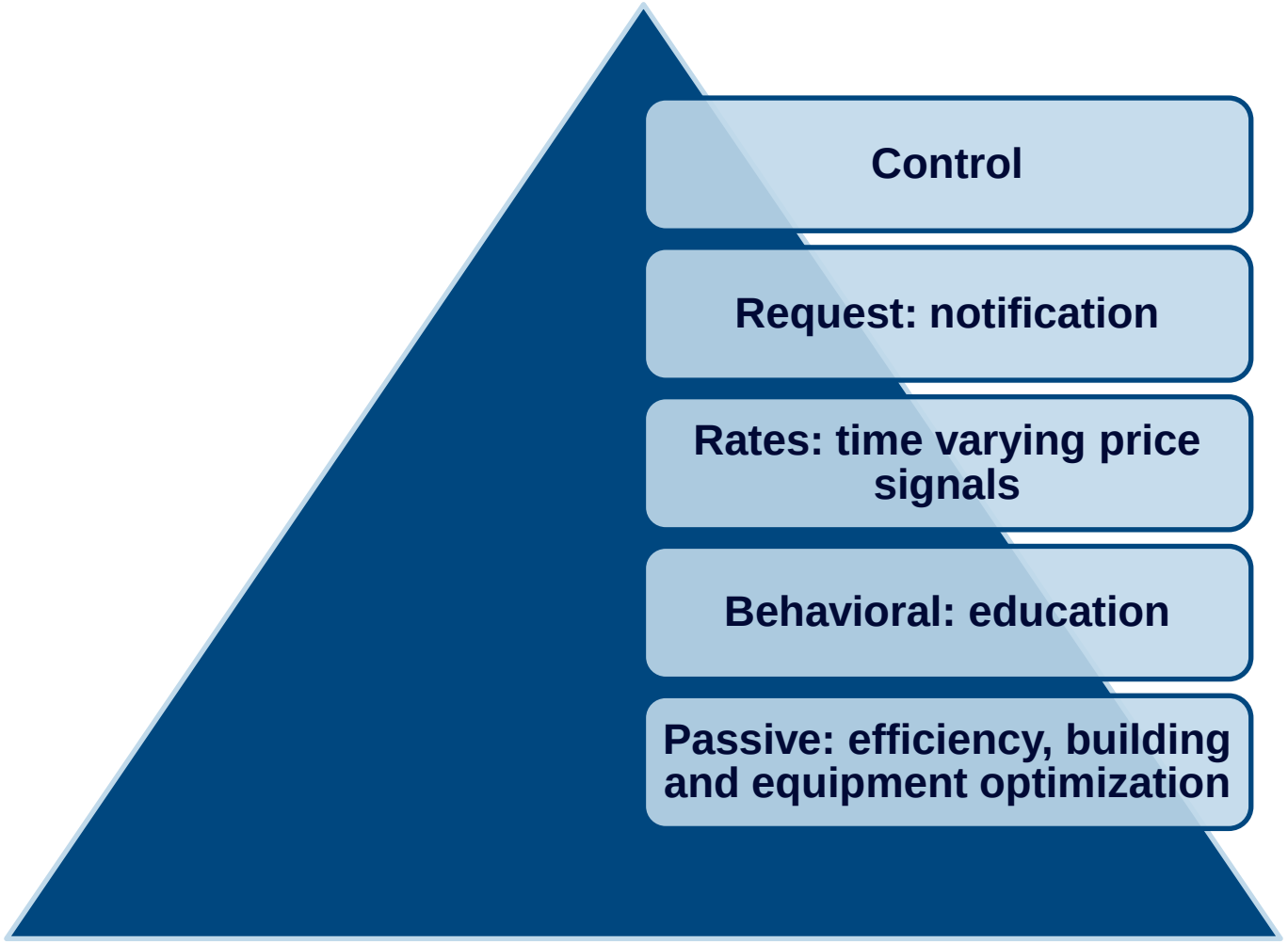
Brian Tholl

Utility Energy Forum

Director, Energy Services

Strategies for Load Management

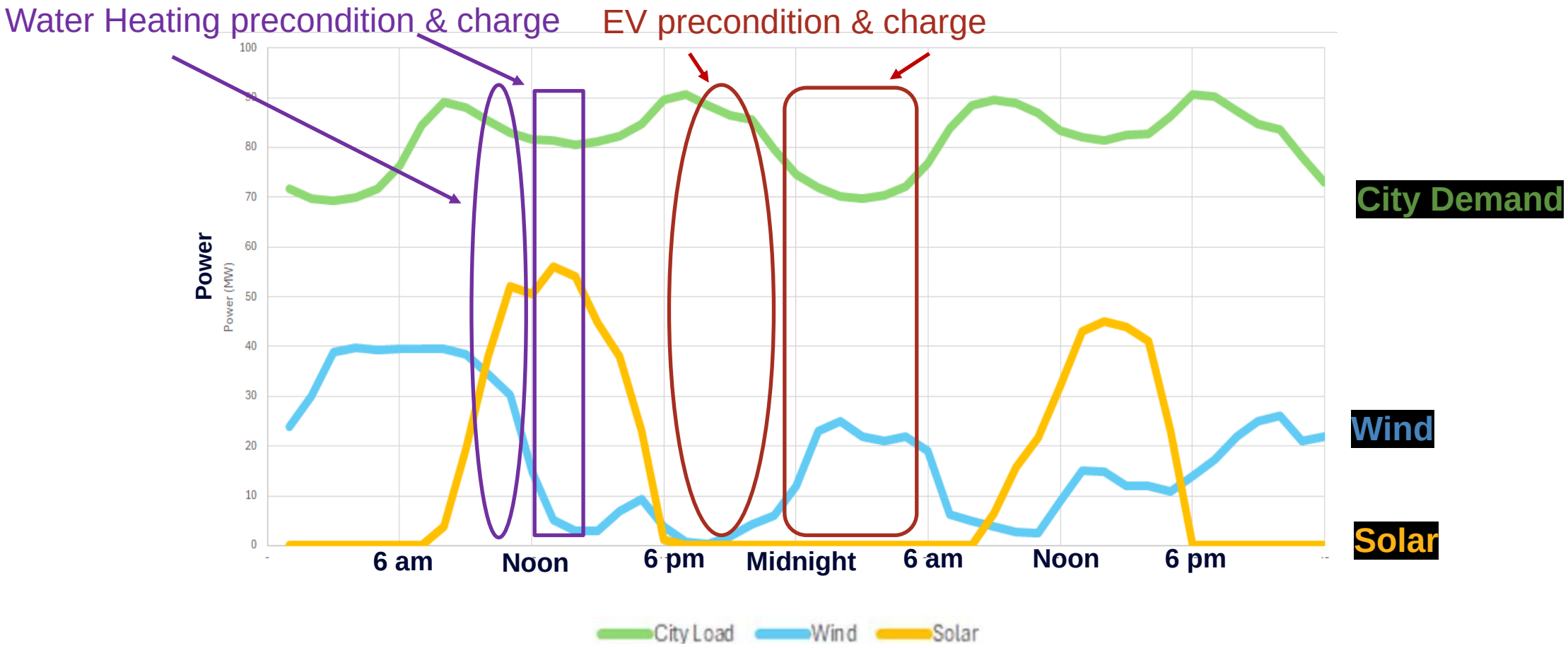
Maximum benefits will come from suite of solutions



- Population 175,000
- Municipal Distribution Utility
  - 2000 miles of distribution lines
  - 55 square miles
  - 320+ MW peak
  - **Time-Of-Day pricing for all residential**
  - **Reliability 99.9965%**
- Climate Action Plan Goals
  - 20% reduction by 2020 (**actual 24%**)
  - **50% reduction by 2026**
  - 80% reduction by 2030
  - Carbon neutral by 2050
- Home to
  - Colorado State University
  - High tech & beer industries

OUR CLIMATE FUTURE

Grid Flexibility – Meeting renewable goals cost effectively



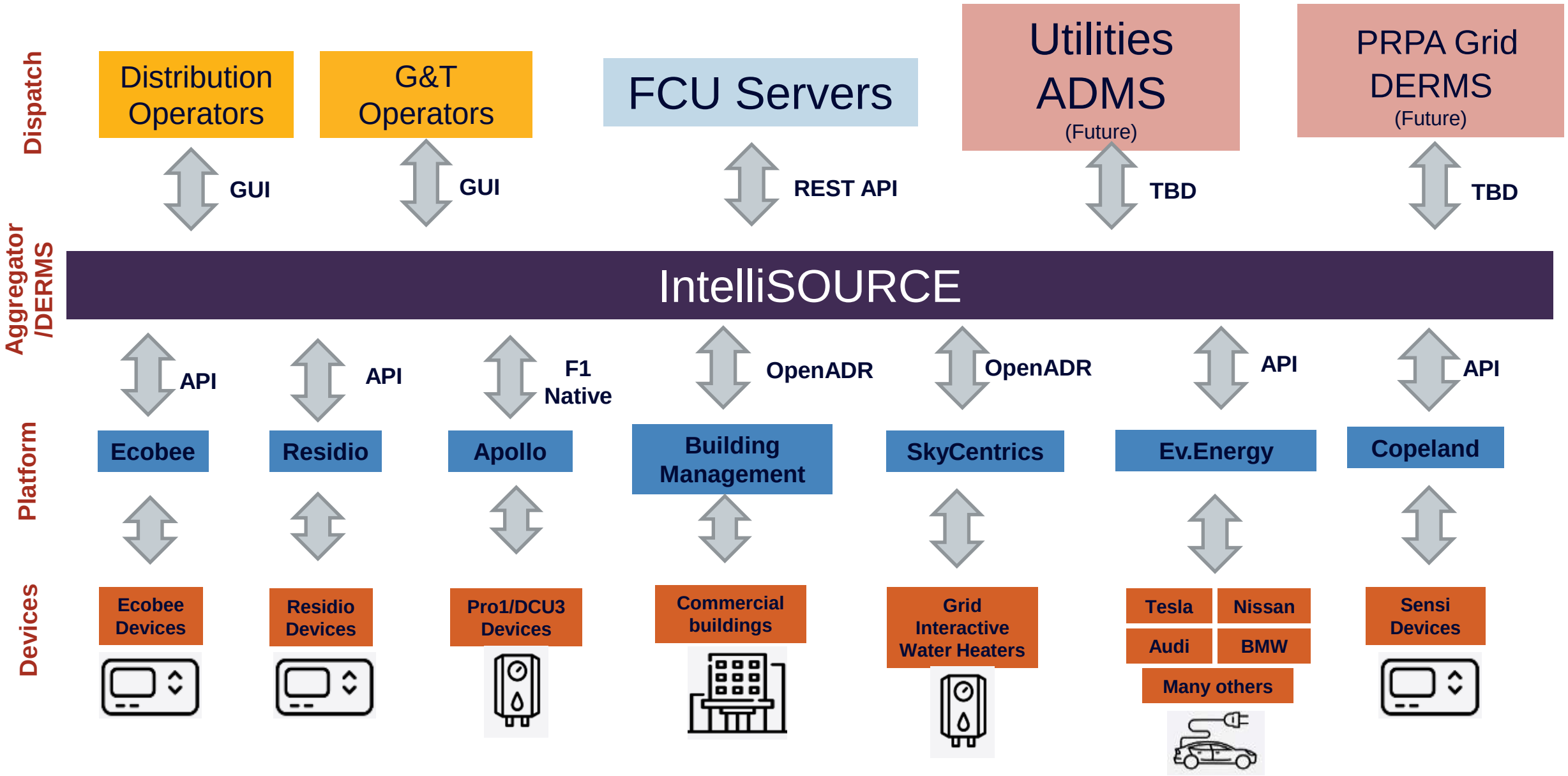
Consumes renewables when they are in low demand

Reduces total installed renewable capacity needed to serve the load

- Distributed Energy Resources Management System (Edge DERMs)
- Equipment/Interfaces
  - Wi-Fi thermostats
    - Direct Install and "Bring your own thermostat"
  - Standard Electric water heaters
  - Grid Interactive water heater
    - CTA-2045
  - Electric Vehicles (2023)
  - OpenADR
    - Commercial & Industrial

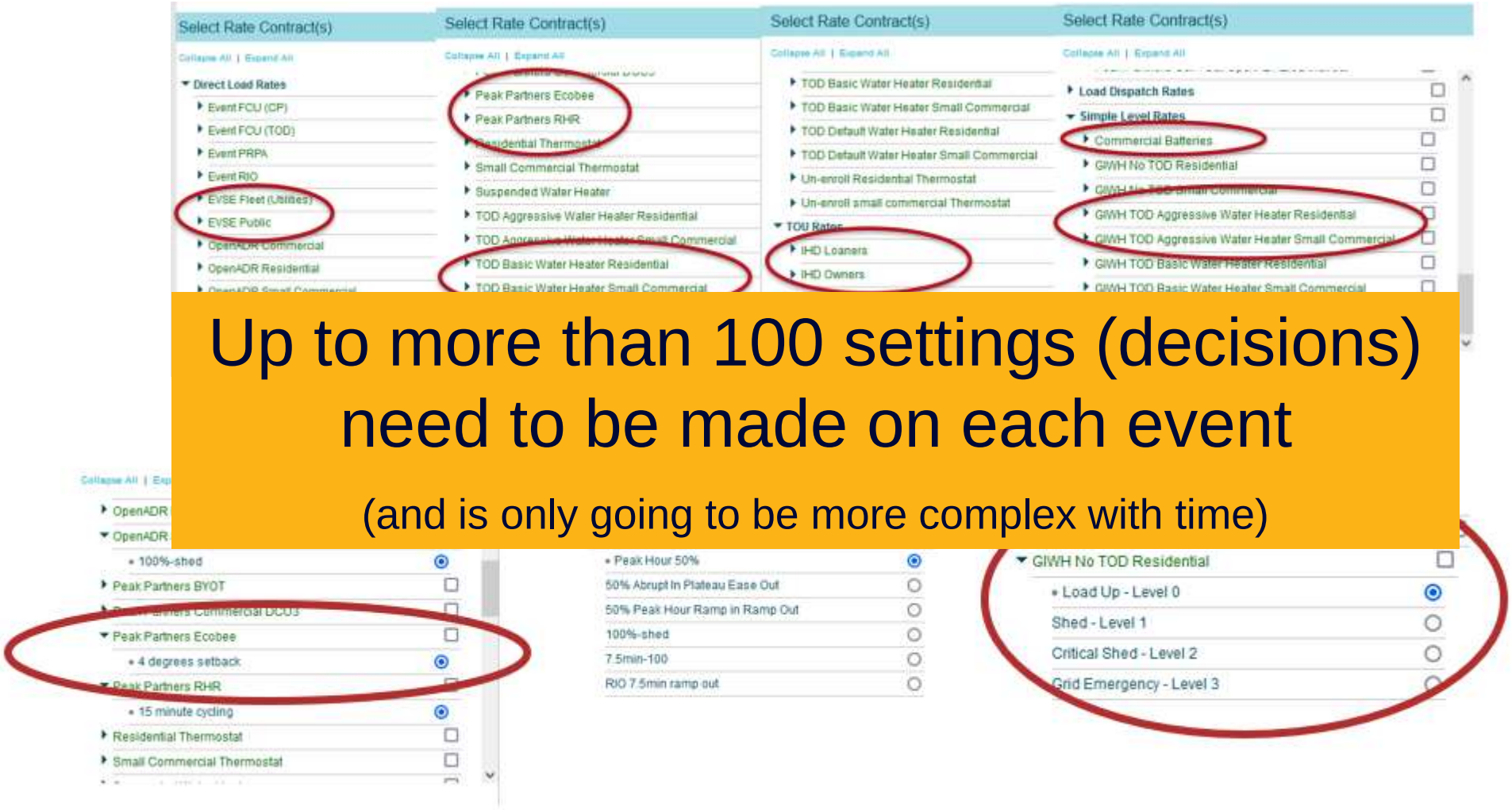
- About 3,500 devices and 7 large commercial
- Effective capacity of -5.5 MW / +2.4 MW
- Current functions
  - Peak savings
  - Time of Day (TOD) load shifting
  - Solar noon consumption

DERMS system architecture



IntelliSOURCE – Dispatch complexity (Capability)

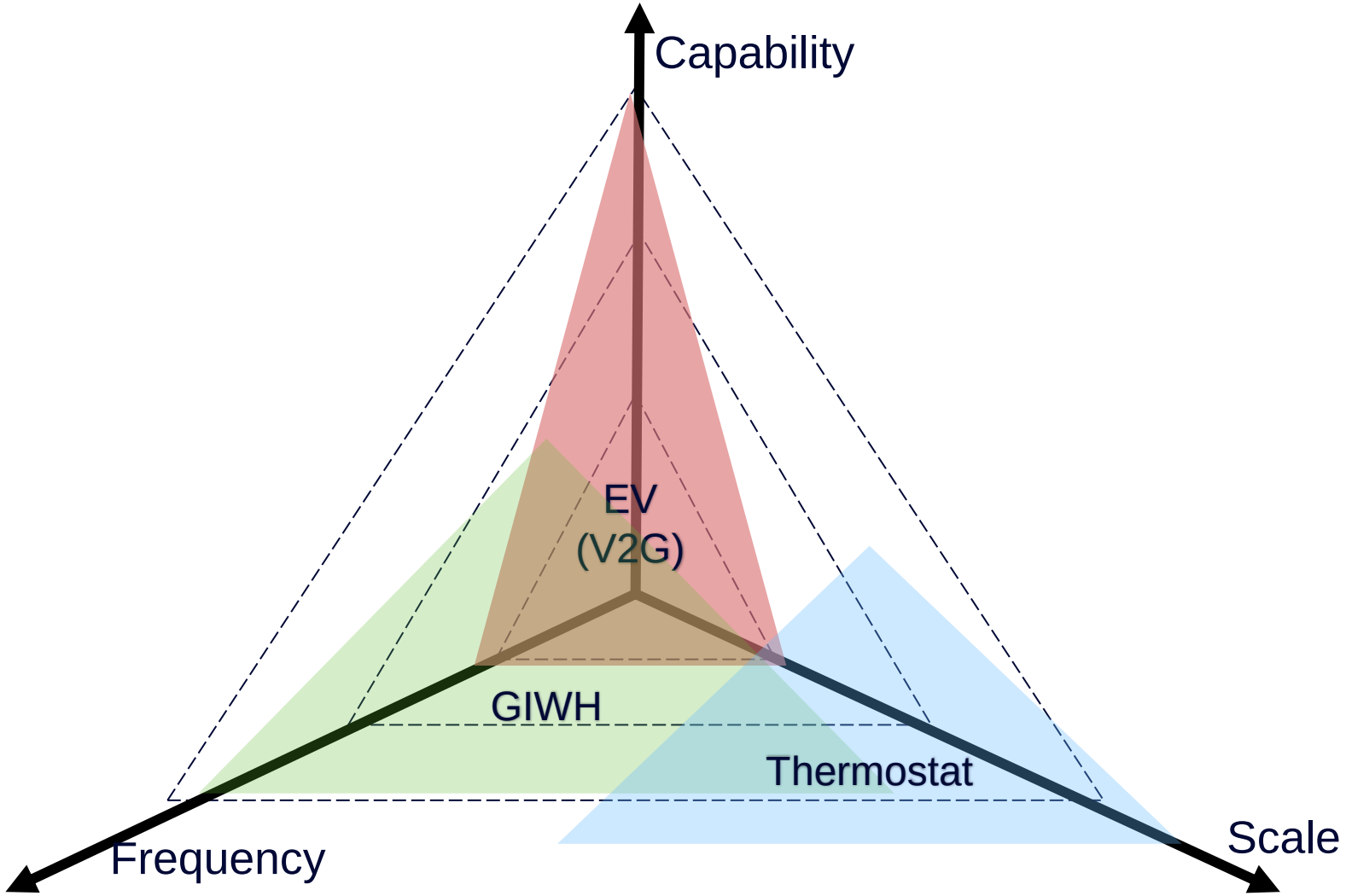
Main parameters: Topology, Resource, Time and Duration



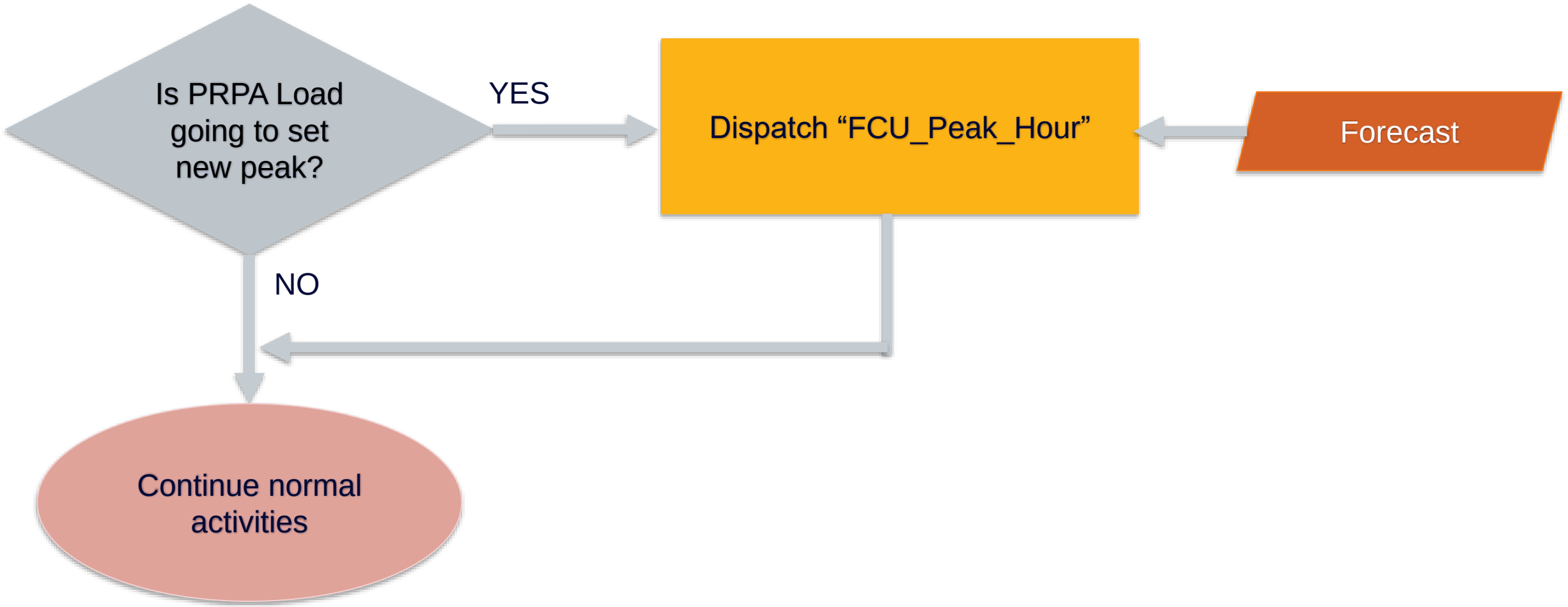
Up to more than 100 settings (decisions) need to be made on each event

(and is only going to be more complex with time)

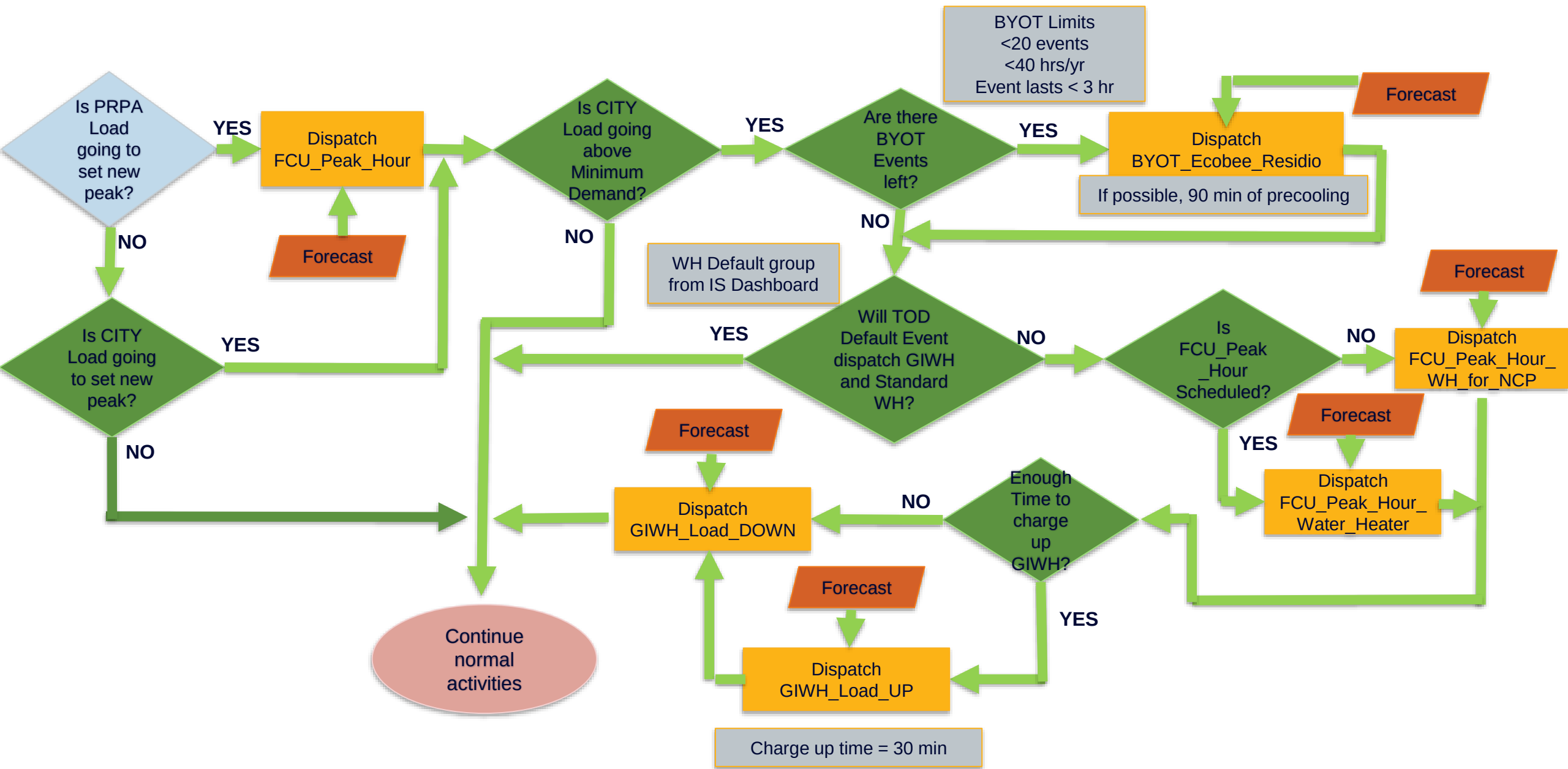
Key considerations for flexibility: Capability, scale, and frequency



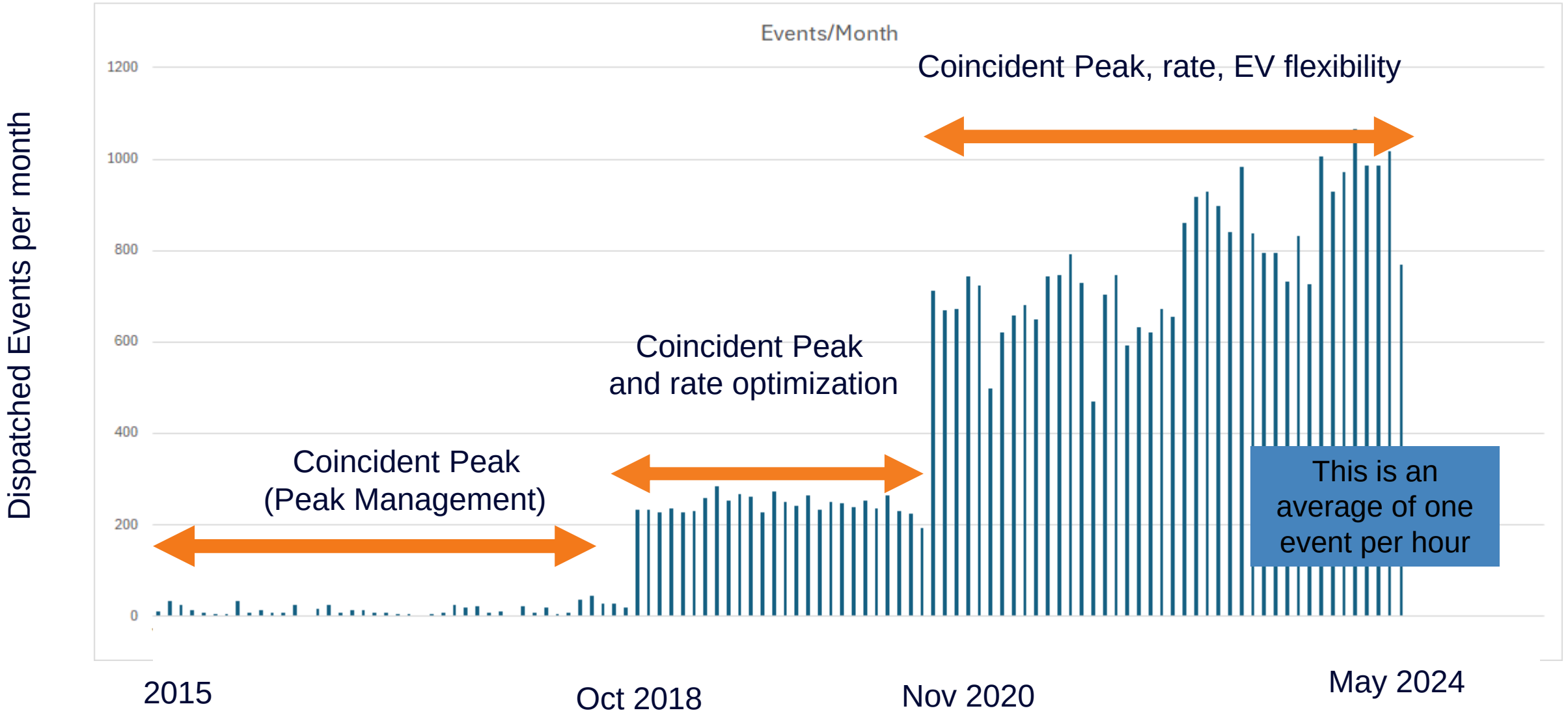
Old dispatch decision flow chart



"New" Dispatch Decision Flowchart



Evolution of DERMS dispatch (Frequency)



Solar noon and time-of-day operation (with pre-cooling and pre-warming)

Challenges: Electric Vehicle Load Management

Max Load Available is ~ 7.8 kW per EV.
But then one or more of the following challenges arise:

- Not connected to vehicle
- Not plugged into charger
- Not actually charging
- The customer opted out

This will result in average load shed by controlled device to be ~0.4 kW

Challenges: Thermostat Load Management

Max Load Available is 3 kW per enrolled thermostat. But then one or more of the following challenges arise:

- Thermostat not connected
- Thermostat is in cooling mode
- Customer opts out
- Customer overrides

This will result in average load shed by controlled device to be 0.6-1.0 kW

Customer Perspective: FC Solar + Storage Program Survey

Survey Question: What other concerns do you have about connecting to a system that allowed Fort Collins Utilities to manage a battery storage system at your home?

*"I am not worried about outages, we've had just 4 of any significant length in 30 years, all under 6 hours max… **I like the peak shaving aspect for the utility and us overall**."*

*"Battery technology, at this time, has a short lifespan...on the order of ~1500-2000 cycles depending on how it is used. **I'd want to restrict that cycle use to only peak-power times,** otherwise the cost benefit greatly reduces."*

*"**Security -** what if Fort Collins Utilities was hacked? What could happen to my home and system?"*

*"I would not be interested in having the city control my battery at all. **You should incentivize us to act** in the way you'd like."*

"(I) Do not want anyone to manage my system but me."

*"Don't want it won't use it if mandated I will shut the system down. **It is mine not yours."***

- Upstream connectivity
  - Fort Collins DERMS to ADMS
  - Fort Collins Edge DERMS to Platte River Grid DERMS
  - Platte River Grid DERMS to ISO/RTO market
- Peer connectivity
  - AMI/MDMS, GIS, asset management, work orders, etc
  - "Real-time" data processing
- Downstream connectivity
  - DER assets
  - Metering

Thank you!

DER Quantities to achieve 2030 OCF Goal (Based on RFP 2022)

Resource	Device Sink (kW)	Device Shed (kW)	Quantities (2030)	Capacity Sink (MW)	Capacity Shed (MW)
GIWH	3	0.4	2,000	6	0.8
EV	2.5	1	300	0.75	0.3
Batteries	2	1.5	300	0.6	0.45
Thermostat	0	1	5,000	0	5
Resistive WH	2.5	0.4	2,000	5	0.8
			Directional	12.35	7.35
			Absolute	19.7 MW	

Notes

Device Sink/Shed includes Load Diversity (challenging factor to measure)

Quantities to reach goal are to be evaluated and refined in a 2-year cycle

Grid Flexibility resources – Progress towards goal (RFP 2022)