Data Centers

Presented on the Momentum Savings Monthly Call
May 3rd & June 7th

Why should we

CARE?

350-450 aMW

7th Plan

Embedded Data Center Load

55aMW

Savings Potential

With no program in place to capture it

7th Plan Potential, 2016-2021

So what is a data center?

Closets

Server Room

Localized Data Centers

Mid-Tier Data Centers

Co-Location, 'Colos'

Enterprise

What they all have in **common**

Priorities

Security

Reliability

thereafter, efficiency

IT Equipment

- Servers
- Storage
- Networking (communications)

HVAC and Infrastructure

- Cooling
- Power management

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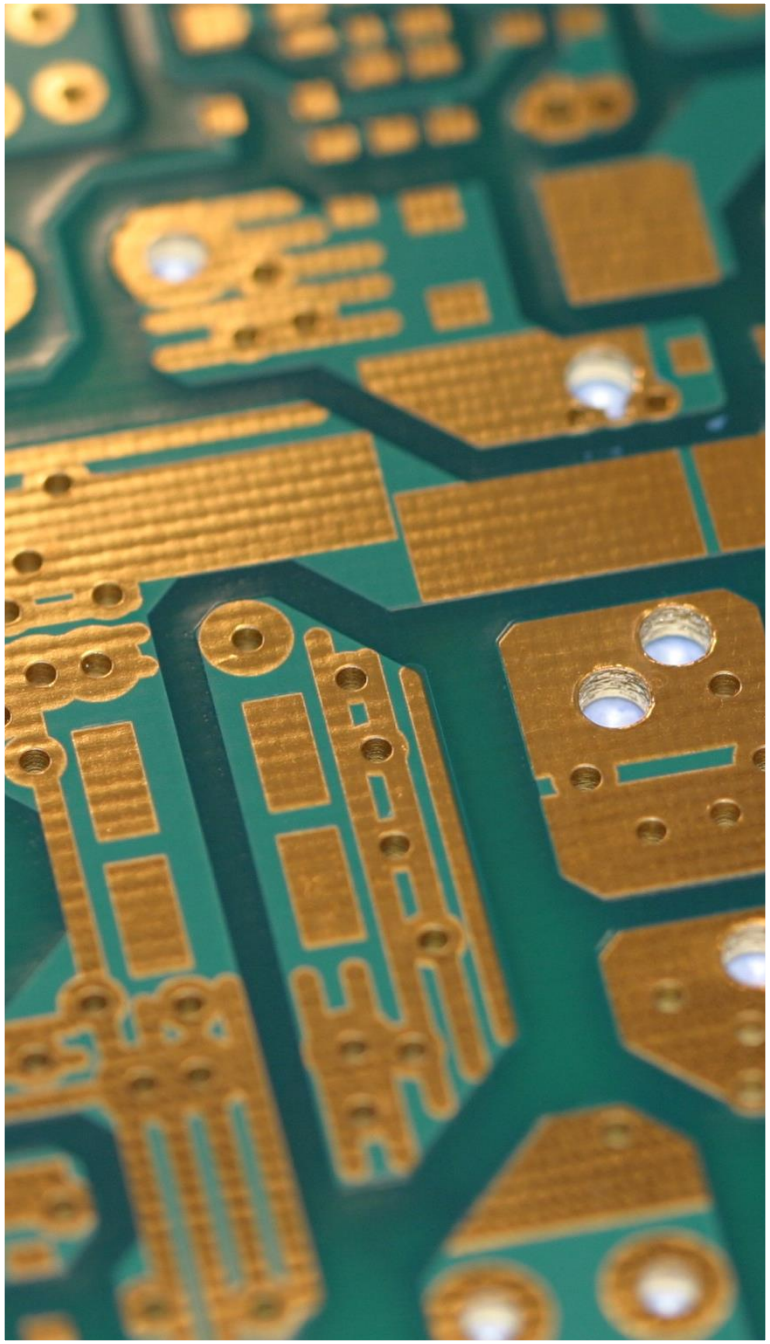


IT Equipment

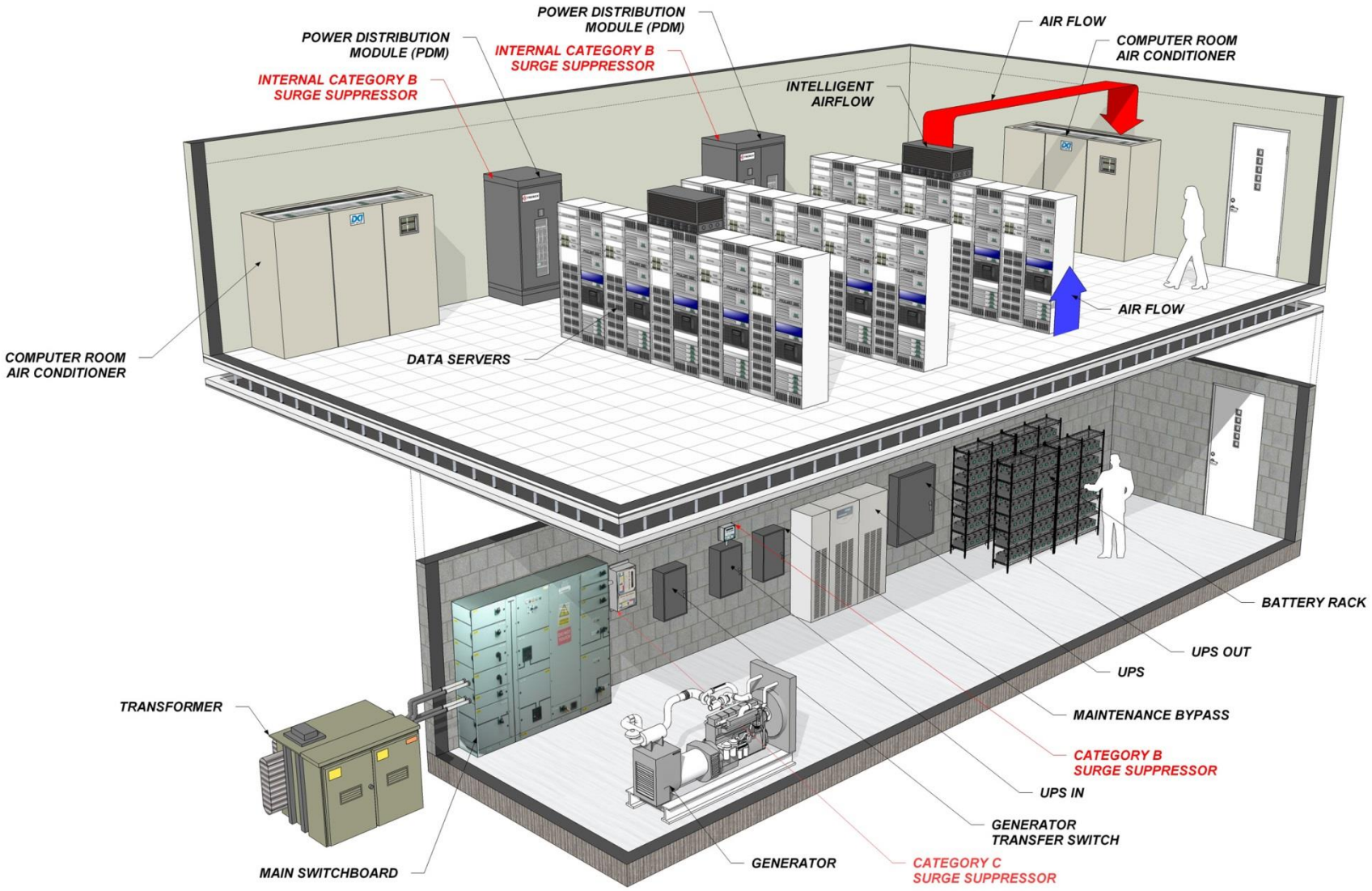
- Servers
- Storage
- Networking (communications)

HVAC and Infrastructure

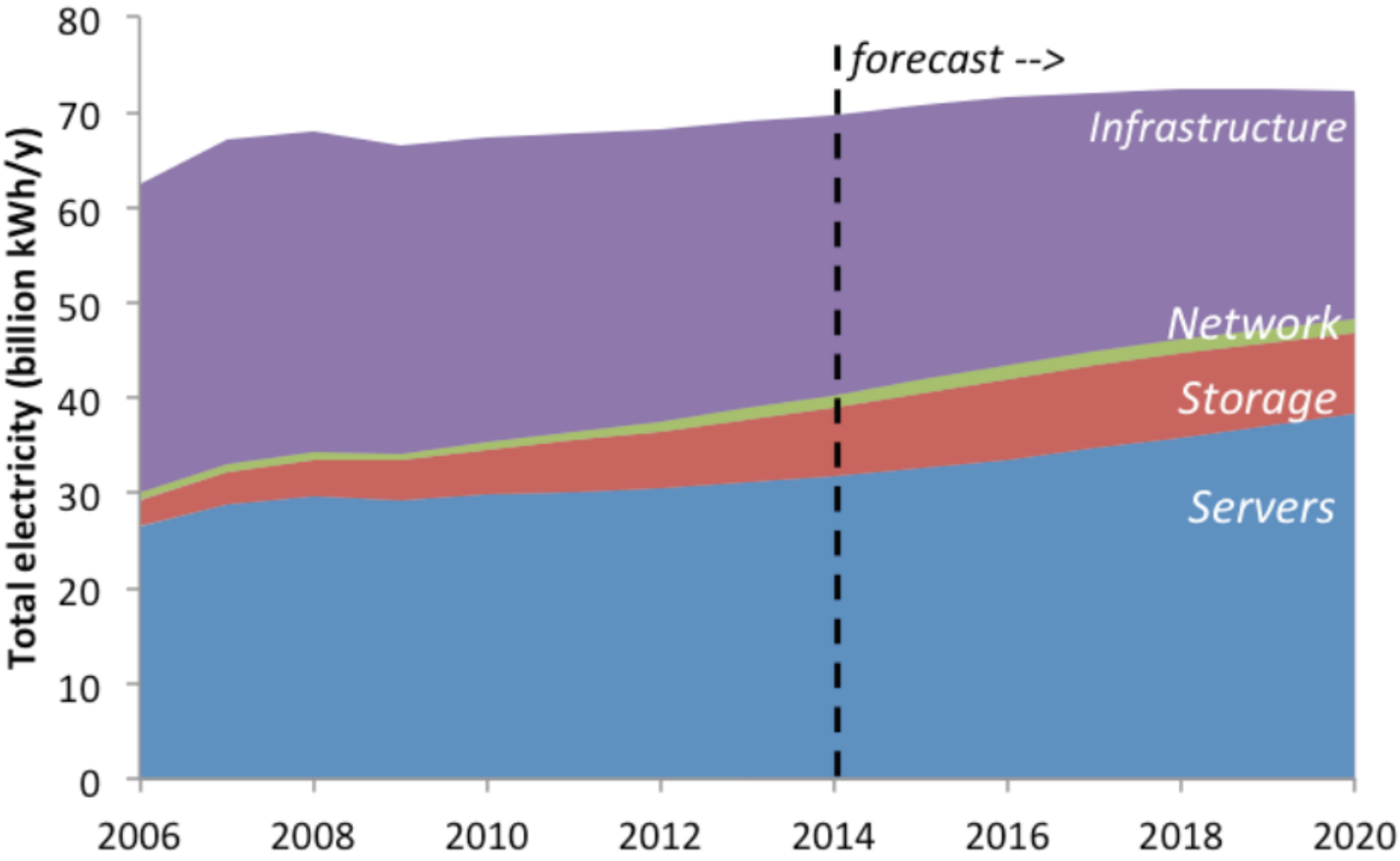
- Cooling
- Power management

Computer Wattage → BTUs

IT and Infrastructure



Consumption Nationally



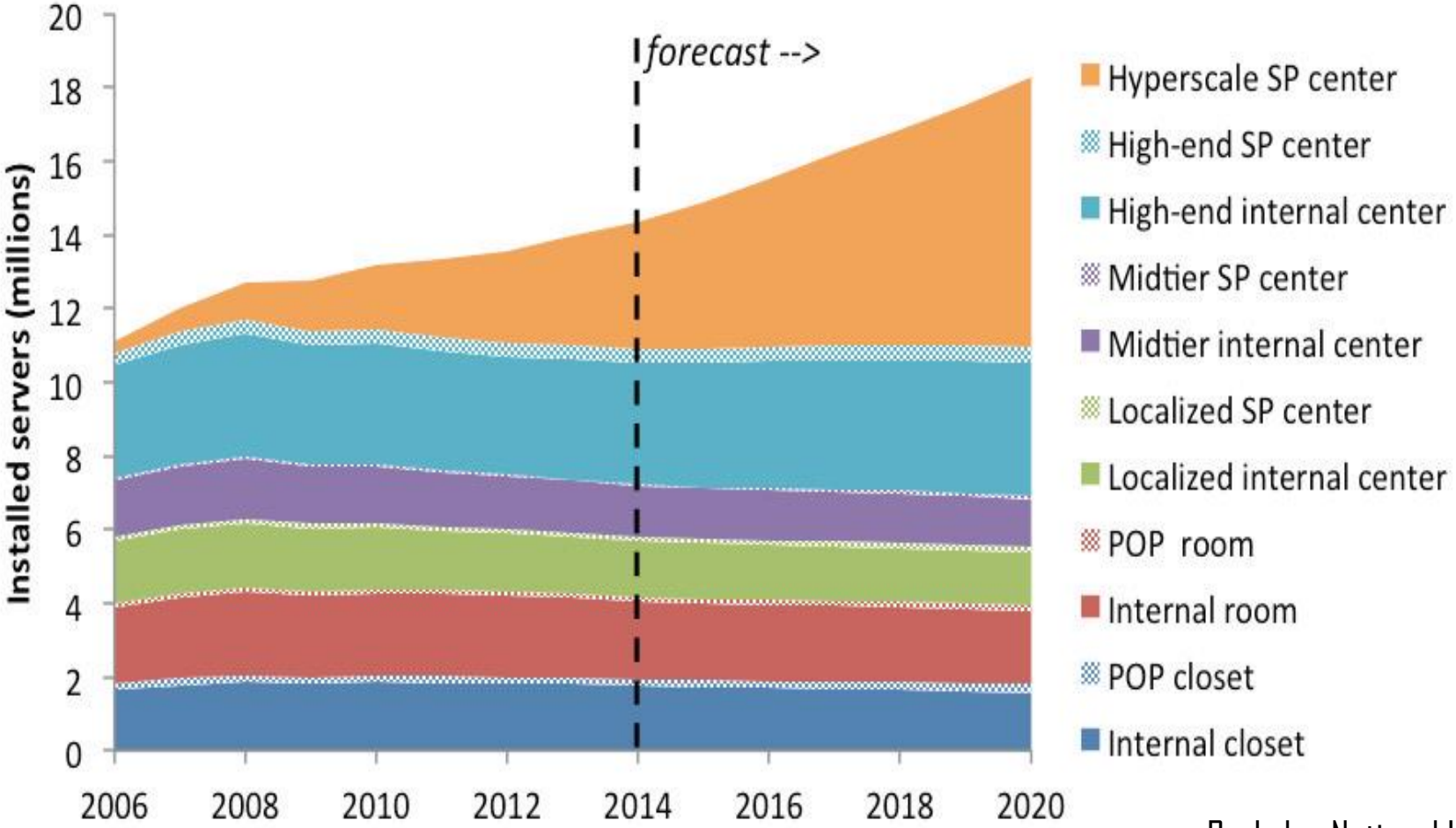
Berkeley National Lab

Data Centers in the PNW

Enterprise	???
Mid-Tier	500
Localized	700
Server Rooms	20,000
Server Closet	16,233

CBSA

Trend to Enterprise DCs



Berkeley National Lab

Getting EE into the DC

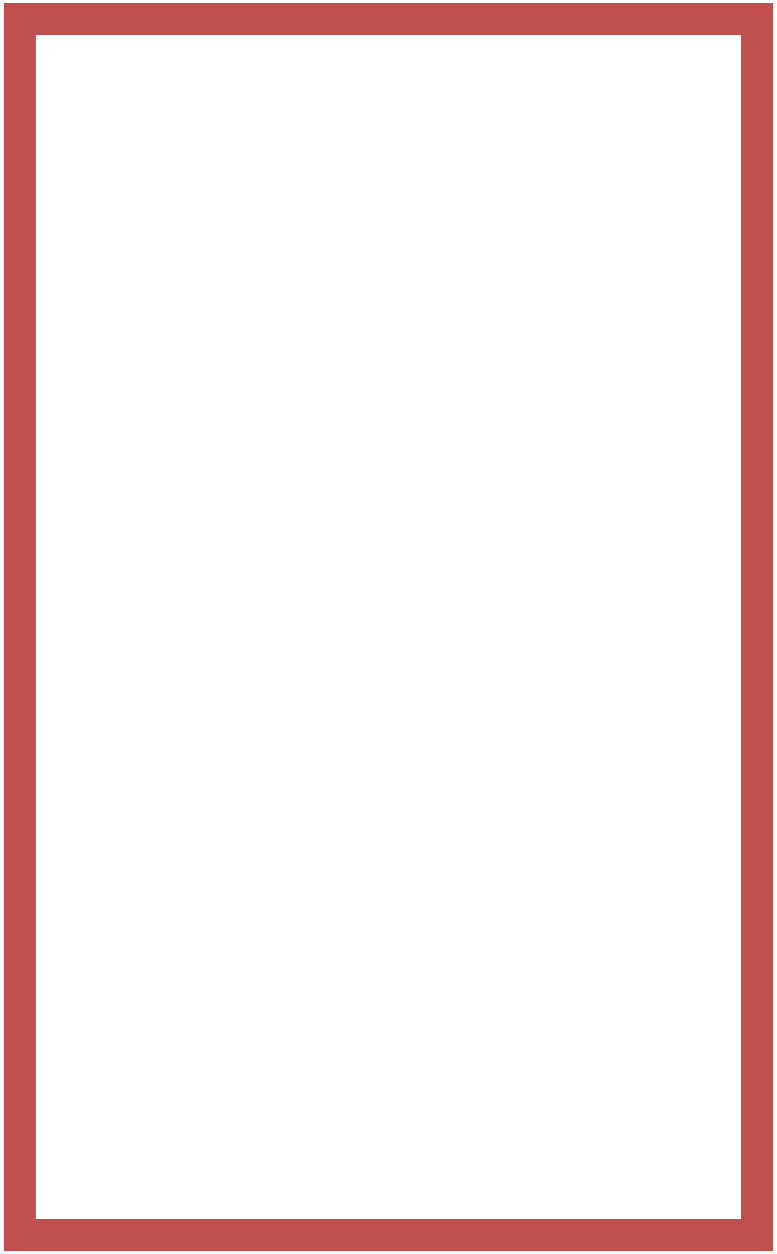
7th Plan Scope

EE savings from embedded DCs only

- Assumption: enterprise DCs high-efficient facilities

Criticism for being overly optimistic/aggressive

- Input from Cadmus study and CBSA



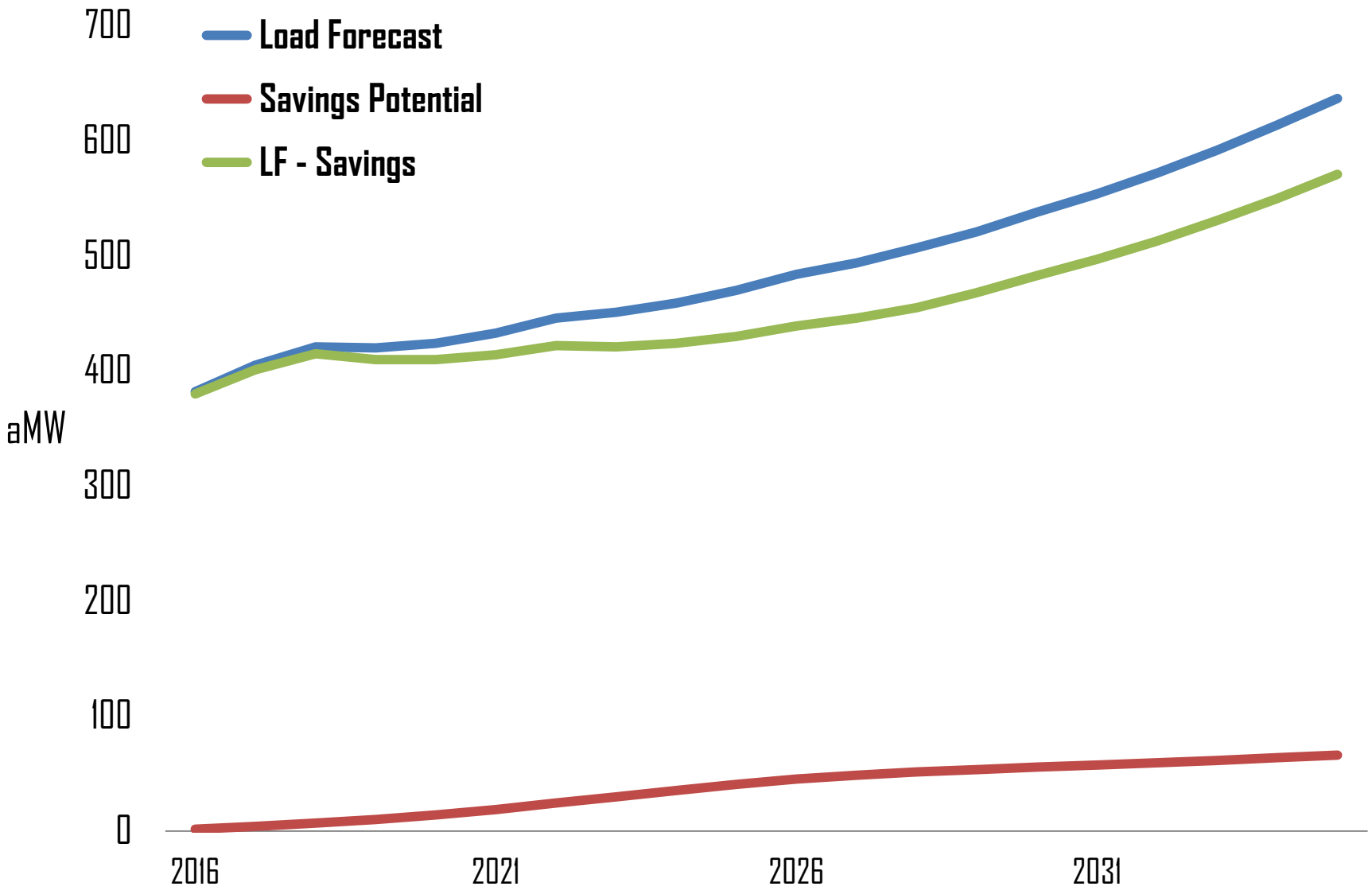
7th Plan Scope

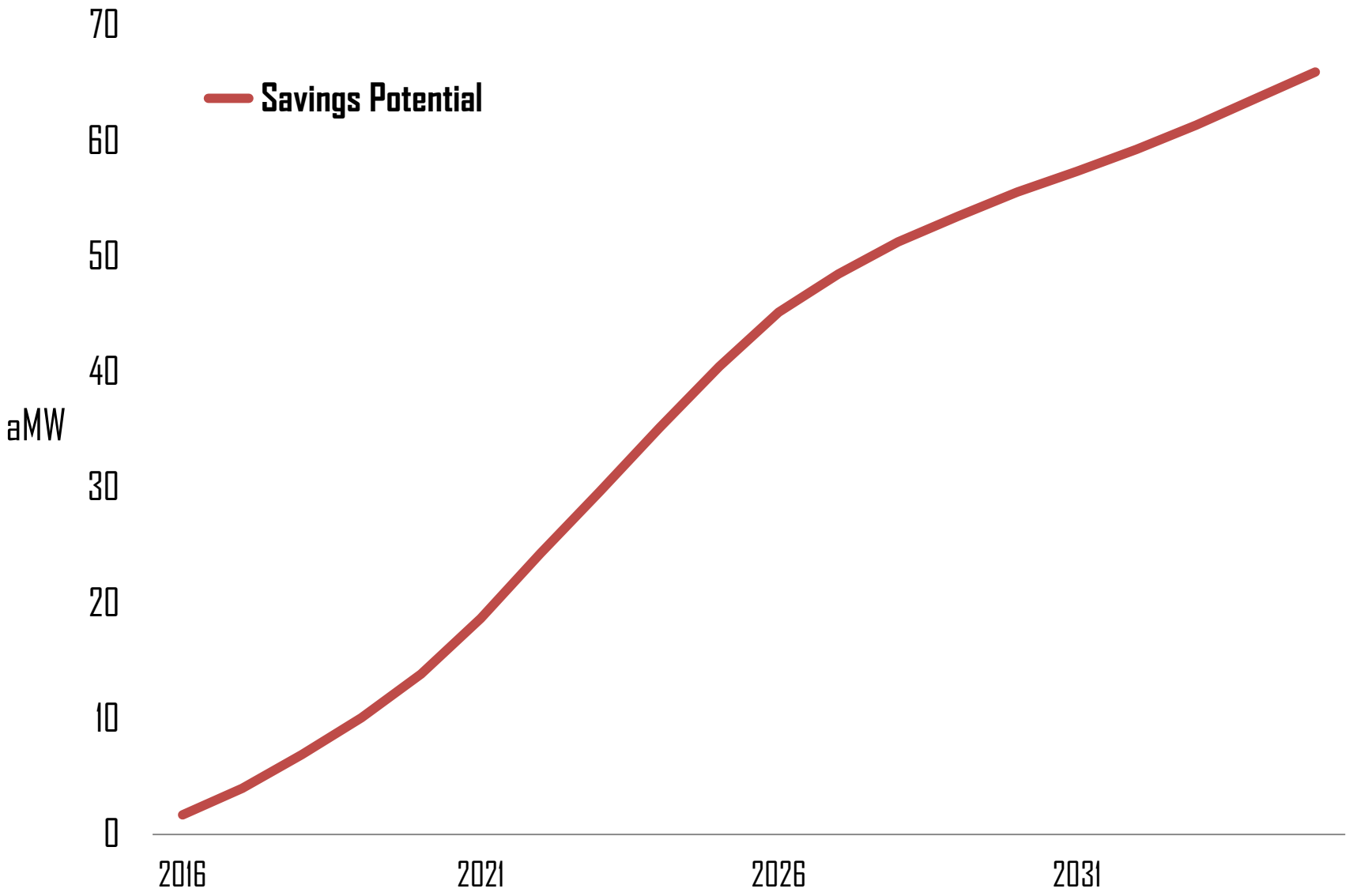
Savings Potential

- 55 aMW 5-year potential
- 750 aMW 20-year potential

Load Forecast

- 405 aMW in 2017
- 637 aMW in 2030
  - Avg. 2.7% annual growth


Load Forecast
Savings Potential
LF - Savings
700
600
500
400
300
200
100
0
aMW
2016
2021
2026
2031


70
60
50
40
aMW
30
20
10
0
Savings Potential
2016
2021
2026
2031

Practices v. Widgets

Practices

Virtualization (43%*)

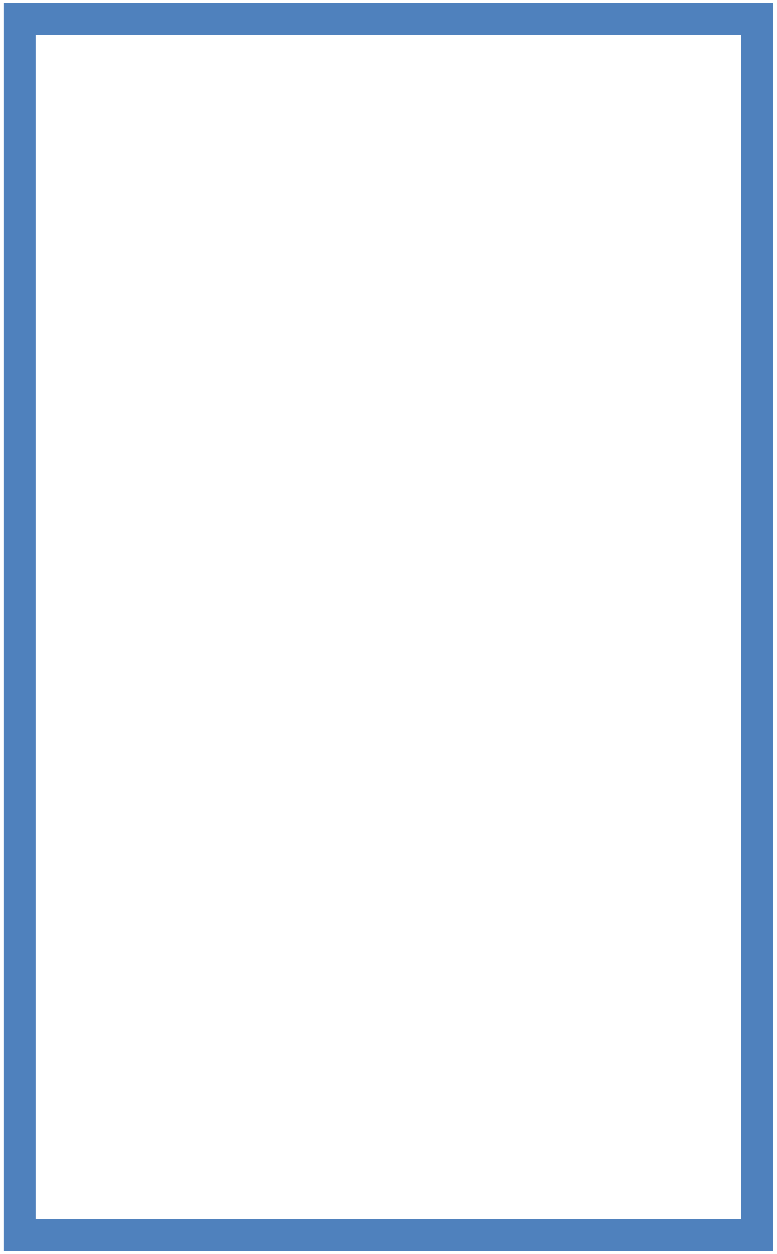
- Running the workload of multiple servers on one physical host server – creates "virtual" servers

Decommissioning servers (9.5%*)

ASHRAE HVAC guidelines

And the **cloud**… more later

* 7th Plan Potential



Widgets

Efficient servers (11%*)

- An ENERGY STAR qualified server uses 30% less energy than a conventional server
- Most energy intensive component

Efficient storage (10%*)

- Far second in energy intensiveness

Efficient network equipment (3.6%*)

- Distant 3rd in energy intensiveness

Efficient UPS (6%*)

- Uninterruptible Power Supply

* 7th Plan Potential

Top Practice & Widget in Use

	% ENERGY STAR Servers	% Virtualization
Enterprise	???	???
Mid-Tier	71%	33%
Localized	44%	27%
Server Rooms	31%	30%
Server Closet	38%	8%

CBSA

Market Analysis

Market Analysis

DCs in our region

Supply Chain

Market Actors

Data Centers in the PNW

	PNW Population	Avg. IT Load kW**
Enterprise	???	?????
Mid-Tier	500	122
Localized	700	16
Server Rooms	20,000	5
Server Closet	16,233	1.3

CBSA

**does not include HVAC

Data Centers in the PNW

	PNW Population	Avg. IT Load kW**	aMW
Enterprise	???	?????	??????
Mid-Tier	500	122	61
Localized	700	16	11
Server Rooms	20,000	5	100
Server Closet	16,233	1.3	21

CBSA

**does not include HVAC

Enterprise Data Centers

Not in the 7th Plan, CBSA – assumed highly efficient

Irony

- All over the news
- Yet, next to no details about what is inside them

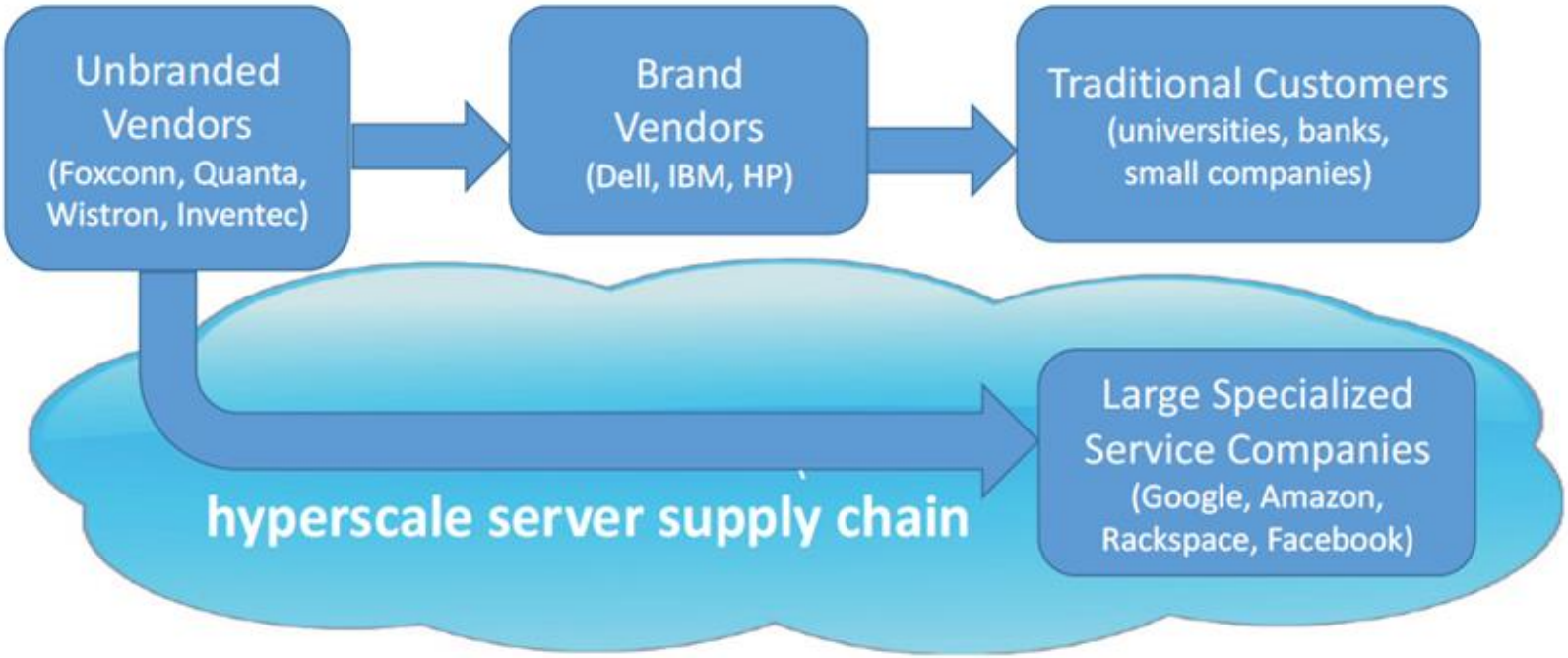
Moving to our region

- Cheap energy/temperate climates
- Trans-Pacific telecommunications hub
- Cloud migration


"Moving to the cloud"
... just means using someone else's computer

Supply Chain

Our understanding of the supply chain is very basic



Supply Chain

…But that's about it

- Are there other channels?
  - Physical v. Financial
- What are the estimate sizes of each channel?
- What is the difference between branded/unbranded equipment?
- Where is the influence?

Market Actors

Supply Chain Market Actors

- Manufacturers, VARs (Value Added Reseller), IT service providers, System integrators

Data Center Actors

- Facilities Manager
- IT Manager
- CFO
- Good information on decision-making process at DC

Market Actors

Need a lot more information – especially on supply chain

- Most information is technology focused
- Who are they? We have a sense of types of actors, but not much info on specific market actor profiles
- What is the difference between them?
- What value-add do they contribute?
- What existing relationships does our industry have with these market actors, if any, that might be leveraged?

Momentum Savings?

Modeling a data center

We have one model for DC energy consumption, what are its weaknesses and strengths?

Sales Data Availability

It appears one source of sales data may exist (IDC), but do any other possibilities exist out there?

Risks and Barriers

Ethan's Gut Feeling

Collecting sales data could be difficult – *if we do that*

No EE program

- Incentives, relationships, etc.

Broadly speaking, little interest in EE

Secretive market

- Market actors, especially large ones (enterprise DCs) may not be open to sharing market intelligence, qualitatively or quantitatively.

Double counting

- End Use types not unique to DCs, e.g. HVAC

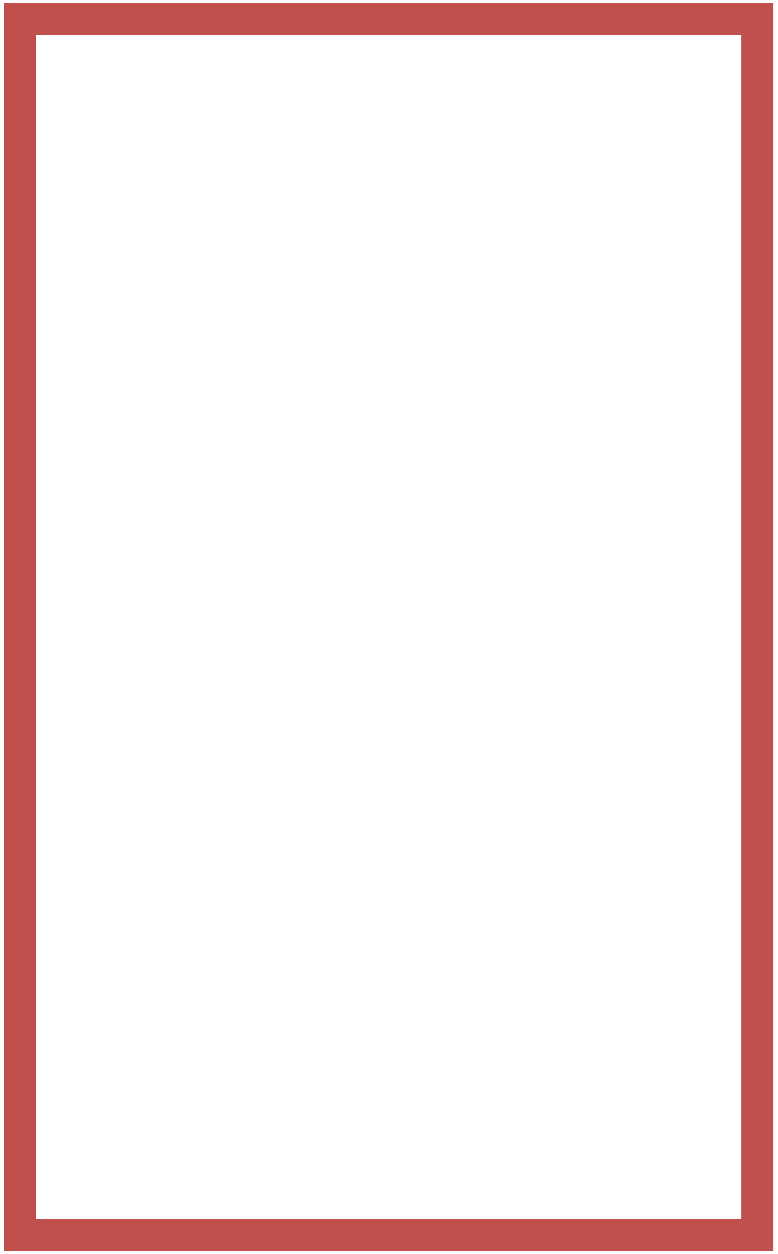
Where next?

Need an 'IT meets EE' expert

- Help us understand the market

There's a lot of niche topics here – what is noise and what is substance?

- We only have the 7th Plan to guide us and it doesn't seem to be a very robust analysis



Where next?

Dig deeper into what we have

- CBSA especially
- Utility Programs

Get a grasp on enterprise DCs

- How many are there? Are they really super efficient?
- Can we get much info on them? Or are they black boxes?
- Should we ignore them?

Where next?

Figure out the technology/efficiency options

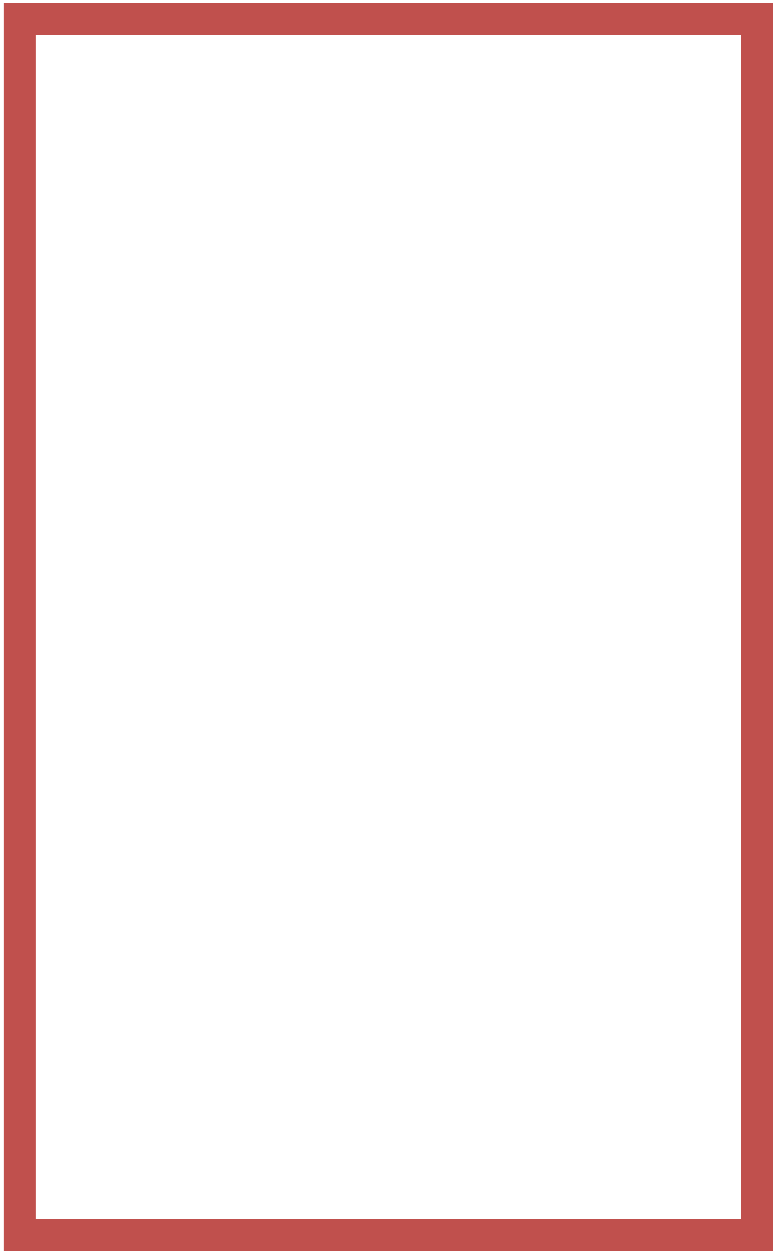
- With lighting, we think:

  Incandescent, CFL, LED…

  What is the equivalent for data centers?

End Use v. Building Type

- Is this a study of data centers, or is it a study of IT equipment?



Sources

Cadmus Study

- Has worked with PG&E on a couple large DC studies

PG&E

- Multiple DC studies

Berkeley National Laboratory

- The lab where data center research is focused – multiple sources

Power Council

- Workbooks

CBSA

- Surveyed small to medium DCs

NEEA

- Embedded DC market actor survey

ACEEE

- Based on NEEA work, embedded data center

Questions?