EXH. MFH-8
DOCKETS UE-190529/UG-190530
UE-190274/UG-190275
2019 PSE GENERAL RATE CASE
WITNESS: MARGARET F. HOPKINS

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**Docket UE-190529** **Docket UG-190530 (*Consolidated*)**
In the Matter of the Petition of **PUGET SOUND ENERGY** **For an Order Authorizing Deferral Accounting and Ratemaking Treatment for Short-life IT/Technology Investment**	**Docket UE-190274** **Docket UG-190275 (*Consolidated*)**

FIRST EXHIBIT (NONCONFIDENTIAL) TO THE PREFILED REBUTTAL TESTIMONY OF

MARGARET F. HOPKINS

ON BEHALF OF PUGET SOUND ENERGY

JANUARY 15, 2020

Next-Generation Data Centers

Ed Sperling None

Cloud computing may be getting the headlines, but that hasn't diminished interest in building new data centers.

The new data centers are being designed differently, though. They're more modular, more flexible and much more accepting of new technology as it becomes available. The idea of building a data center every decade has met wit the economic reality inside most companies. It's simply too expensive.

So what exactly is different? Forbes sat down with Steve Sams, vice president o site and facilities services at IBM , to find out.

Forbes: What's happening inside data centers these days?

Steve Sams: More than 75% of our customers are experiencing major challenges. Their IT growth continues to explode and they're trying to run all o this in data centers that are up to 20 years old. The average age of a data cente according to a recent IDC study, is nine years old. Gartner suggests any data center more than seven years old is obsolete.

Why does it become obsolete so quickly?

Technology price/performance improvements are delivered by getting things into smaller and smaller footprints. Technology becomes more dense. The

amount of power and cooling required if the rack is fully loaded has been climbing steadily. ASHRAE (American Society of Heating, Refrigerating and Ai Conditioning Engineers) estimates that over the last decade technology density has increased 20 times. If you build a data center to support racks that are running at 1,000 watts per rack and you're installing blade technology that's running at 20,000 watts per rack, you have a mismatch. That's occurring inside data centers all around the world.

Isn't that one of the reasons companies are migrating to clouds?

We're certainly seeing a lot of business for data servicing companies, where we're building data centers for them, as well as for companies that are in-sourcing their cloud environment--or continuing to grow in a more virtualized way. In countries with more of a capital crunch the cloud is very popular. In countries like China and India where the customers are more focused on owning the assets themselves, they are interested in owning the data centers. There's been a huge mismatch between data centers and technology. Technology historically got refreshed every three to five years while data centers were designed for 20 years.

How do you get around this?

We designed our own center in Raleigh, N.C., to be flexible. As technology changes and as computing models change, like cloud computing, then you can incorporate those changes even if they're not known well in advance. Data centers have been built using estimates of where your business would be in 15 to 20 years, and where technology would evolve. We've created an implementation of leading edge, flexible, modular design. Additional capability can be plugged into the data center as the demands and the environments change over time.

How do you do that?

We basically adopted the laptop model where you can plug in more memory, additional disk drives. The majority of the cost of a data center is like a memory chip. It's a component, whether it's a cooling unit, a generator, or batteries.

What's the projected life of the new data centers?

They're expected to last 15 to 20 years.

Can they last longer?

Maybe. Will what's viable in March 2010 still be viable in March 2040? No one has a crystal ball that good.

Where's the real cost in data centers?

About 60% of the costs are the electrical and mechanical costs. That's the air conditioners, the storage tanks for generators, the UPSes (uninterruptible power supplies). If you increase the amount of power from 1 megawatt to 2 megawatts then you've doubled the costs that represent 60% of the data center.

Is there any work under way to allow servers to operate hotter than in the past?

There are new standards to allow the technology to run in a much higher humidity range. That allows companies to increase the temperature and reduce the energy costs because you don't have to do as much air conditioning.

We've basically gone from mainframes to PCs to mainframes. Why?

If you have a Wintel server that is running virtualized applications, then to some extent it has followed the mainframe. If you look at server utilization, it all makes sense. We had one client where 60% of their servers were running at 3% utilization or less. We consolidated those servers. We took out five of every six servers that were installed and moved it to the sixth server. That resulted in

huge savings in operational costs like maintenance and power. It also freed up huge amount of the data center for more capacity.

Do you use the same architecture for massive data farms like Google **and** Yahoo **?**

No. There are a handful of organizations installing servers thousands at a time in a standardized way. Most of our customers are installing environments that are not homogeneous because they're aligned to different kinds of workloads. That's why this idea of going to a modular design is so valuable. You start with something today, but as your needs change and your requirements for power and cooling increase you can plug in components to upgrade the data center.

Is performance still important or is it now all about power?

It's being driven in both directions. Cost of energy is becoming a much bigger deal. When we analyze capital and operating costs--and we're building 200 to 300 data centers a year--customers had not looked at the operating costs. Whe you build data centers at a much higher density, energy is a bigger portion of th bill. We just built a data center for about $50 million. To run that data center over the next 20 years will cost the customer about $250 million.

Why have power costs suddenly become such an issue?

Two things. One, the cost of energy historically was low and energy usage was relatively low. But density has changed. IDC estimates the average customer over the past 10 years has increased their server capacity by six times and their storage capacity by 69 times. Over the last five years energy use has doubled. If you combine that usage increase with price increases, then energy becomes a bigger portion of the bill. As a point of comparison, data centers use 40 to 80 times the energy of traditional office space. The second factor is that if the clier looks at the data center's energy consumption, it's a huge portion of the

corporation's total energy use. IBM's data centers represent about 6% of our floor space and 35% of our total energy consumption.

Does virtualization change that?

A decade ago everyone talked about the massive price/performance improvement in computing. The assumption then was that no one would actually need another data center. They would build one data center and what was inside would actually diminish over time rather than grow. Price/performance improvements mean you can get access to new applications and demand has always exceeded the capability to deliver new technology. If w virtualized everything would the ultimate demand grow or decline? Or would it accelerate even faster? We don't know the answer to that.

Why is computing becoming more centralized?

People are figuring out how inefficient the distributed model is. Customers are consolidating data centers. We took a major bank in China that went from 36 data centers down to two. They're saving $180 million a year in operating costs On a smaller scale we took a college in Rhode Island from four data centers down to one and they cut their capital and operating costs by 20% to 30%.

Ed Sperling is the editor of several technology trade publications and has covered technology for more than 20 years. Contact him at esperlin@yahoo.com.

See Also:

Computing's Swinging Pendulum

The Not-So-Fine Art Of Jailbreaking

Re-thinking IT

Ed Sperling