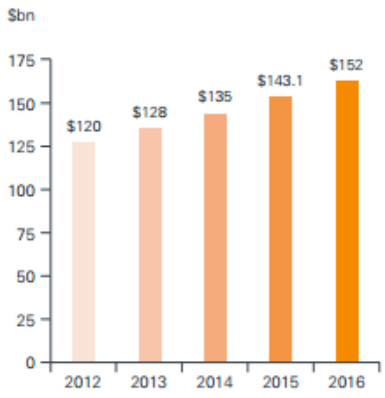
How power, growth and cost will change data centers

Global data center infrastructure spending 2012-2016

APAC will account for ¼ of world- wide data center infrastructure spending by 2016



Source: Canalys

The current understanding of data center performance is concerned with uptime above all else, in particular the fabled 'five nines' availability promise. Power efficiency has been sacrificed on this altar – data center operators build highly redundant electrical and mechanical support systems; they keep servers running indefinitely to provide for unexpected peaks in demand that call on new capacity in the blink of an eye.

Yet this time is drawing to a close. Increasingly, the focus has shifted to availability at the *right* cost. Virtualization makes more efficient use of Information and Communications Technology (ICT) systems, seamlessly handling variable usage and quickly shifting workloads from overburdened or failing hardware. This shifts emphasis to overall power efficiency.

Energy usage and efficiency is a big challenge for the region. The Asian Development Bank's projections show Asia Pacific's energy demand increasing at 2.1% a year through 2035, exceeding the world's average growth rate of 1.5%.

The region will account for more than half the planet's consumption, with electricity consumption more than doubling as economic growth and rising affluence drive demand.

Across the world, but especially in APAC, demand for data center facilities is growing. But alongside this trend is a heightened awareness of sustainability – not just to reduce the reliance on increasingly expensive electricity, but to create better data center density that makes more intelligent use of scarce resources and provides the best return out of what is an increasingly critical and heavy investment for many organizations.

By 2020, a fifth of the electricity generated in the region will be used to create and power ICT equipment and services. Everything from the manufacturing of smartphones to the delivery of web search results will use 20% of the electricity we generate. Data center power demands in APAC shows an average increase of 6.4% from 2012 to 2013, with markets in Malaysia, Indonesia, Singapore and China showing increases above the global average.

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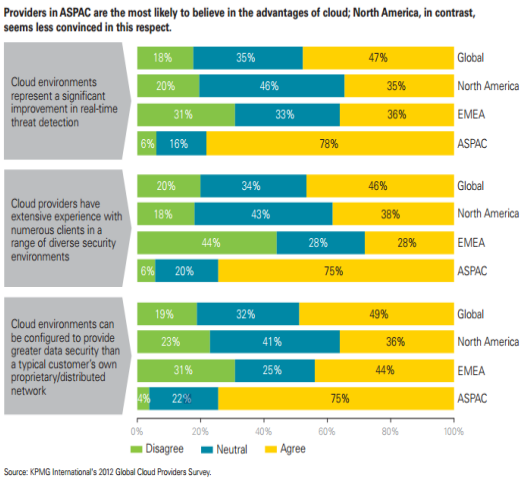
2014 and beyond

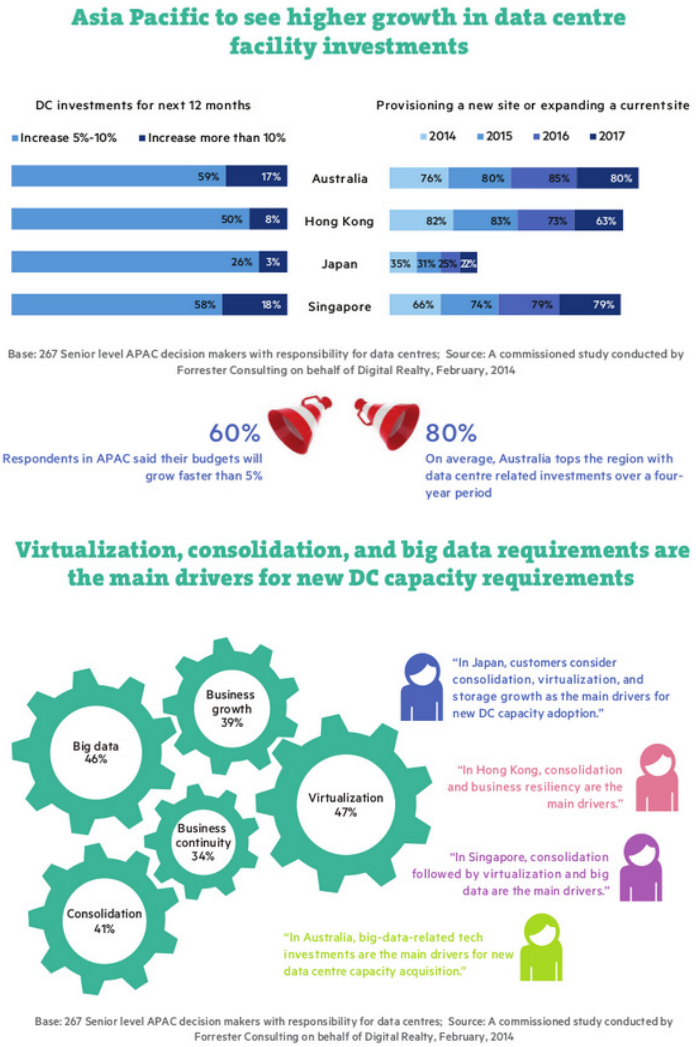
- About half of the respondents said their data center budgets will grow by 5%-10% in the next 12 months
- About 11.5% said they plan to increase budgets by more than 10%
- Main factors driving growth:
  - Virtualisation
  - Consolidation
  - Big data requirements
- Providers in Asia Pacific are the most likely to believe in the benefits of cloud compared to their counterparts in North America
- Asia-Pacific data center infrastructure management (DCIM) market is expected to grow from $107 million in 2012 to $1,140.9 million by 2017, at an expected CAGR of 60.5% from 2012 to 2017.

This growth is for good reason, however – ICT as a whole, and data centers in particular, are a massive generator of economic growth. Fast- growing regions like APAC can expect demand for data center capacity to grow even faster than worldwide figures suggest Spending on data centers in Asia Pacific would grow by 6.7 per cent to US$28 billion this year, driven primarily by the Chinese market, while worldwide data center spending growth outlook for the same period has been cut to 2.6 per cent.

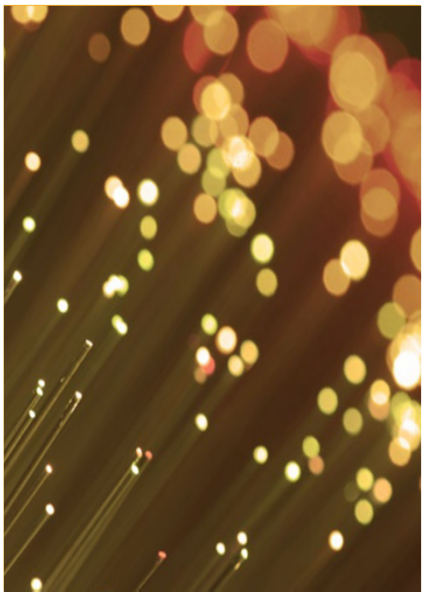
Increasing demand for electricity, coupled with growing demand for capacity, is challenging enough, but there is a third issue: the cost of energy is also increasing. Aside from the growth in data center requirements, this is nothing new; Japan, the UK and USA have all suffered from oil shortages in the past, and energy efficiency legislation in Japan is directly linked to the fallout from the 1979 oil crisis in that country. A previous study on the cost of electricity has shown that natural gas costs 26.8% more to produce per kWhr than coal. In 2013, the share of natural gas in Singapore's fuel mix rose to 91.79% further proof that our energy costs are only set to increase.

In the short term, natural gas is making up the shortfall – and it is likely that deposits that were uneconomical to mine can now be exploited. Fracked gas is a reality and the APAC region leads the way in exploring seabed deposits of frozen methane. This is helpful – as solar, wind, nuclear and hydroelectric power is unlikely to quench the demand for more electricity – but all of these energy sources are more costly than traditional means of generating power – using, for example, coal fired power stations.





Source: Forrester Research



Energy use

- One data center can use enough electricity to power 180,000 homes
- Data centers consume up to 3% of all global electricity production while producing 200 million metric tons of CO2
- Established data center markets, such as Hong Kong and Australasia, saw slight decrease in data center power requirements
- Emerging data center economies in South East Asia and China continue to show increase above the global average of 7.2%
- A research by the US-based Natural Resources Defense Council (NRDC) shows that a typical data center wastes large amount of energy powering equipment doing little or no work – the average server operates at only 12-18% capacity
- Achieving just half of technologically feasible savings could cut electric use by 40% and save U.S businesses $3.8 billion annually

Focus on Singapore

Singapore facilities have an average power usage effectiveness (PUE) - a measure of how efficiently a computer data center uses energy - at 2.6, which exceeds the Green Mark for Data Center's ceiling of PUE 2.2.

Energy bill accounts for more than half of the operating expenditure in a typical data center in Singapore.

- Mature technologies being used as compared to those in emerging markets like Malaysia and Indonesia, and hence older data centers
- Older server population estimated to consume 60% of server energy but deliver only 4% of performance capability
- Government's Intelligent Nation 2015 (iN2015) ten year-plan to grow the Infocomm sector further increases energy usage in data centers

Increase in power MV

Asia Pacific

Rank		2012	2013	% Increase
1st	Malaysia	220	255	15.9%
2nd	Indonesia	100	110	10.0%
3rd	Singapore	930	1,020	9.7%
4th	China (PRC)	1,560	1,700	9.0%
5th	Other markets	3,950	4,300	8.9%
6th	India	1,250	1,300	4.0%
7th	Australasia	1,420	1,380	-2.8%
8th	Hong Kong	320	310	-3.1%
	ASIA PACIFIC	9,750	10,375	6.4%

Source: 2013 DCD Intelligence Industry Census

In the meantime, education is needed. One example is with the definition of Power Usage Effectiveness – PUE – measures how efficiently computer data center uses energy. The PUE is a ratio of the total power going into the data center to the power used to run the computing infrastructure within it; so the bigger the number the greater the power usage, with an ideal PUE being 1.0. Yet research from Digital Realty puts average PUE in the region at over 2.5. In comparison, research conducted by Eaton for the European Union recently found that average PUE in European states – which are facing rising fuel costs of up to 30% year on year - ran at between 1.6 and 2.0.

This is just one problem; there is also a focus on the cost of the initial startup of a data center – and not the total cost of ownership, which includes the energy bill. There is also, in some areas, an assumption that the supply of electrical power will be unreliable – and when actually getting power reliably is an issue, sustainability takes a back seat.

Saving energy and costs

In the data center, opportunities for efficiency improvements are prevalent. This is especially true on the IT or server side, which has largely gone unaddressed. Many data centers are only using between 10% and 15% of supplied electricity to power servers that are performing actual computations. By addressing inefficiencies at the equipment level, the cascade effect will allow maximum energy savings throughout the data center one watt of power saved at the server level can generate as much as 2.84 watts of savings along the entire data center power chain.

Data Center Energy Use

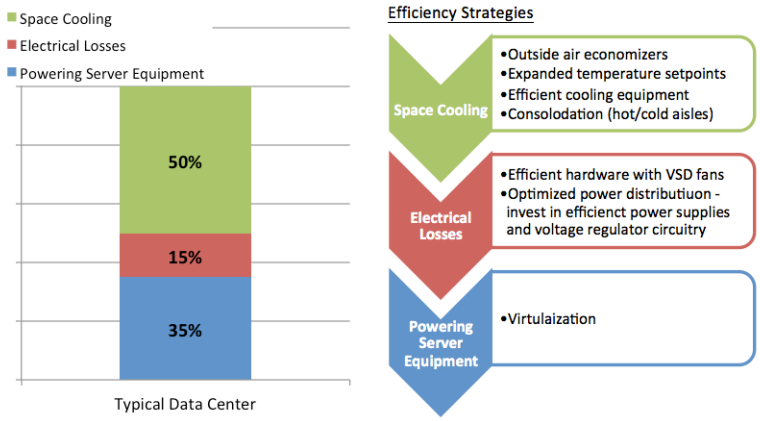


Figure 2: Energy Use Breakdown and Efficiency Stratgeies for Data Centers

Source: Rocky Mountain Institute

Some tips

- Virtualize and consolidate
- Take advantage of today's high efficiency UPS and power distribution systems
- Consult best-practice floor plan designs
  - Hot/Cold aisle layout
  - Distribution of power across racks
  - Minimize or eliminate underfloor cabling
- Efficient cooling system design including:
  - Air containment systems
  - Economizer mode

What will happen in the future?

The cost of energy will go up – and the need for more efficient data centers will become more and more apparent. The capital expense of buying a data center either for an organization or a third party provider is significant – but the operating cost of running such a venue in an inefficient manner will become increasingly prohibitive.

Lateral thinking is called for. In countries lucky enough to have a low ambient temperature, natural air cooling helps lower fuel costs. Inside the Arctic Circle, Facebook has built a data center near the town of Lulea which makes use of wintertime temperatures of -41° Centigrade, for example. But the use of local water supplies – be it swimming pools, rivers or the Pacific Ocean itself, as a heat sink is also worthy of consideration.

The data center industry needs access to reliable, protected, clean power. This feeds into another issue; while more mature economies in the region - such as Hong Kong, Taiwan, South Korea and Australia – are already beginning to use highly advanced data centers with excellent power efficiency, the regions with the most potential growth are not. There is a risk that the gap in this two- speed market will become ever-wider if left unchecked.

Conclusion

Huge energy consumption, enormous economic and internet usage growth, coupled with steadily rising energy costs, means that data center operators and customers in APAC will need to practice sustainability – not least because consumers are increasingly asking about the wastefulness of the services and products they use. On top of this moral imperative is the business imperative: in an era when the cost of powering venues like data centers completely eclipses other costs, data center operators and customers need to think of efficiency as well as availability and performance. The three are interlinked – and do not cancel each other out.