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Telemedicine, the Microgrid, and AI

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While today's world of technology news is filled with hyperbole—some even extending into the realm of fiction—what I will discuss here regarding telemedicine, the microgrid and AI (artificial intelligence) is based on existing ideas that, in turn, are based on proven, working technologies that address real, known issues.

Microgrid vs. Megagrid

Very succinctly, the "microgrid" is a renewable energy system.[1] In Vietnam—with its two annual seasons of hot and hotter—a renewable energy system means capturing photons to generate electricity from solar panels rather than from oil or coal.

The microgrid is critical because it is the source of the electricity required to run the end-use application of telemedicine (Figure 1). It is more effective when it is not a micro-appendage of its older and much bigger cousin, the megagrid.

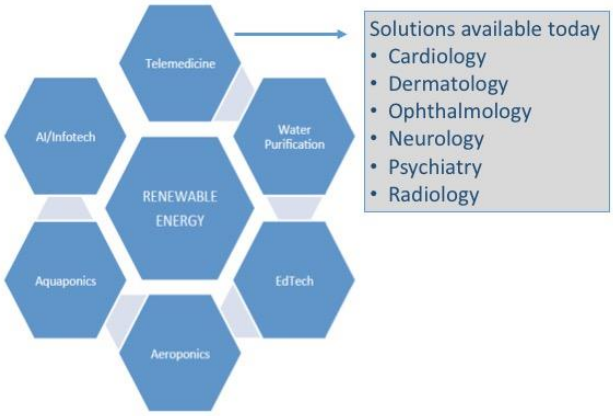

Figure 1. The microgrid as a renewable energy source offers a range of end user applications, including telemedicine.

Typically operated and maintained by an electric utility monopoly, the megagrid is based on a century-old platform that is complex and difficult to maintain. Because of the huge amount of capital required to build a megagrid, the utility is generally set up as a monopoly with very strict technical and operating regulations.

Furthermore, government regulators generally follow a policy of user pricing that is designed to recoup these capital expenditures plus a profit for the utility's shareholders. The result is a business model skewed toward increased capital expenditure that raise prices—instead of favoring cost-reducing technologies. The expensive legacy platform is—to use a non-energy metaphor—the dog that wags present and future tails.

Advantages of a Microgrid

As a stand-alone electricity system, a microgrid avoids the complex and expensive regulatory and engineering burdens of tying into and being a part of a giant utility's megagrid system. The microgrid offers increased reliability and resilience.[2] Moreover, it prevents the monopoly utility from influencing or controlling local use of the electricity generated by and stored at the microgrid site. (As listed in Figure 1, an additional inexpensive end-use application of microgrid-generated electricity is water purification, which would significantly reduce the incidence of bacterial diarrhea, hepatitis A, and typhoid fever.)

The Microgrid/Telehealth Connection

When we examine the distribution of benefits provided by telemedicine, a critical link with the microgrid becomes apparent. The benefits of telemedicine center on several key factors listed in Table 1.

Table 1. Healthcare problems addressed by telemedicine

- Shortage of physicians
- Skewed distribution of medical expertise and healthcare facilities towards urban areas
- Expense of healthcare delivery
- Real-time access to healthcare specialists through smartphones

My company[3] recently launched a telemedicine initiative in India. The situation there—while not identical, is similar to that in Vietnam.

- 70% of the population of 1.3 billion live in villages
- 90% of secondary and tertiary care facilities are in cities
- 75% of specialists live and practice in 6 cities in India
- Inadequate medical facilities in villages

The World Health Organization reports[4] that the shortage of physicians worldwide is compounded by maldistribution among the population (Figure 2). The immediate benefit from telemedicine is access for millions of people to healthcare specialists based on remote diagnostics, remote monitoring, and the more efficient division of expertise among physicians, physician assistants, and nurses. Telemedicine applications can ensure that patients receive first-rate, high-quality care through a combination of proven diagnostic tools administered and monitored by trained physician assistants and nurses, thereby freeing physicians for more specialized care.

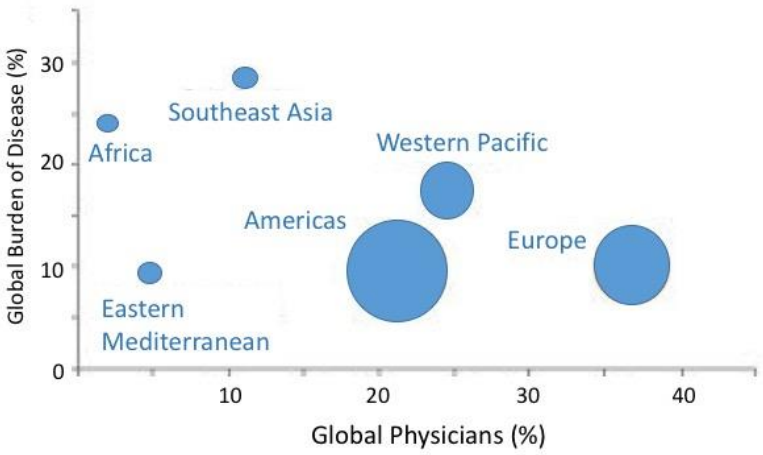

Figure 2. Physician distribution by burden of disease and health expenditure. Size of circles represents global share of expenditure. World Health statistics, 2006.[4]

Specifically, for Vietnam, telemedicine can play a key role in economic development and continued high growth rates. Based on current estimates,[5] Vietnam spends approximately 7.1% of its GDP on healthcare. This is compared to 10.2% in Japan and 11.3% in Germany—both large, mature economies with efficient healthcare systems—and 17.1% in the US.

One of the reasons the Vietnam figure is lower is that the healthcare infrastructure is maturing. Another is that Vietnam has a young, relatively healthier population. A healthy population is the engine that will continue to drive economic growth. As Vietnam's healthcare and health insurance industries mature, expenditures will increase. And as the population grows older, age-related illnesses will increase.

Telemedicine, however, will enable the many sectors comprising the healthcare ecosystem to contain expenditures at 10% of GDP—comparable to Japan and Germany. The US level of 17.1% would not only dampen Vietnam's economic growth, but would eventually deplete the country's treasury.

Like electric utility companies, the current healthcare delivery model is based on a centuries-old concept of bricks-and-mortar—the hospital or clinic. New clinics and

hospitals require investments of large amounts of capital; with measures of operational efficiency—economic return on that capital—based on bed occupancy. Yet, recent studies reveal that for many illnesses, diagnosis,[6] monitoring[7] and prevention[8,9] significantly increase health levels and decrease the cost of overall healthcare delivery.

Artificial Intelligence

Third—but not least in the ranking of importance—is the role of AI. Many areas of AI-based diagnostic tools enable medical specialists to quickly establish diagnoses and treatment options (Figure 1).

As the poet Goethe wrote, “Art is long, life short, judgment difficult”. The implementation of telemedicine—and the realization of its many benefits—will take time and will not be easy. There are issues of vested interests (who collects the revenue), training and licensure, regulatory and legal systems, inertia of a stable system.

For Vietnam, the lack of a long-established healthcare ecosystem is a major advantage. Existing regulatory, legal, and process infrastructures represent lower barriers to change and acceptance of 21st century technologies.

Each of the three key components are available and are proven technologies.

- The microgrid with electricity from a renewable energy source
- Telemedicine diagnostic, monitoring, and treatment tools that use smartphone communications networks
- AI diagnostic software applications that leverage big data analytics and machine-learning tools

For the Vietnamese, the benefits of telemedicine are there for your taking.

Douglas Shinsato is co-founder of Anthill Ventures, technology incubator with offices in Hyderabad, Singapore, Tokyo, Taipei, and Hawaii. His focus is on the intersection of

sustainable energy, water purification, telemedicine, sustainable food production, food chain serialization (anti-counterfeit), and big data analytics.

Tags:

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References

1. Lantero A. How the microgrid works. Energy.gov. 2014. URL: *http://www.energy.gov/articles/how-microgrids-work*. Accessed 10/8/16.

2. URL: Villarreal C, Erickson D. Zafer M. Microgrids: A regulatory perspective. California Public Utilities Commission. 2014. *https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwinm9riosvPAhVJKyYKHWT2B_YQFggpMAA&url=http%3A%2F%2Fwww.cpuc.ca.gov%2FWorkArea%2FDownloadAsset.aspx%3Fid%3D5118&usg=AFQjCNHvFUBNhKUNOS1iQC71O4QmH3dNDg*. Accessed 10/8/16.

3. Anthill. *URL: http://www.anthillventures.com/#Portfolio*. Accessed 10/8/16.

4. Scheffler RM. Liu JX. Kinfu Y, Dal Poz MR. Forecasting the global shortage of physicians: an economic- and needs-based approach. *Bulletin of the World Health Organization*. 2006. URL: http://www.who.int/bulletin/volumes/86/7/07-046474/en/. Accessed 10/8/16.

5. Health expenditure, total (% of GDP). World Bank Group. 2014. URL: http://data.worldbank.org/indicator/SH.XPD.TOTL.ZS. Accessed 10/8/16.

6. Chapter 5. Reducing costs and improving the quality of health care, White House. 2010. URL: *https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwjZgvq8pcvPAhVGLyYKHeFsD4UQFgg2MAA&url=https%3A%2F%2Fwww.whitehouse.gov%2Fsites%2Fdefault%2Ffiles%2Fdocs%2Ferp2013%2FERP2013_Chapter_5.pdf&usg=AFQjCNEuiBDLTXTeyka9PwxpY5HHfMe-YQ*. Accessed 10/8/16.

7. Soumerai SB, Mah C, Zhang F, et al. Effects of health maintenance organization coverage of self-monitoring devices on diabetes self-care and glycemic control. *Arch Intern Med*. 2004 Mar 22;164(6):645-52.

8. Choudhry NK. Avorn J, Antman EM, et al. Should patients receive secondary prevention medications for free after a myocardial infarction? An economic analysis. Health Affairs. 2007. URL: http://content.healthaffairs.org/content/26/1/186.long. Accessed 10/8/16.

9. Choudhry NK, Patrick AR, Antman EM, Avorn J, Shrank WH. Cost-effectiveness of providing full drug coverage to increase medication adherence in post-myocardial infarction Medicare beneficiaries. *Circulation*. 2008 Mar 11;117(10):1261-8.