

Energy efficiency: the first fuel for developing Asia

Peter T. du Pont*

Nexant Asia 22nd Floor, Rasa Tower 1, 555 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand

Abstract:

Developing Asian economies have the fastest-growing energy demand in the world. This paper provides a brief review of projections of increased energy demand in the region, the expected fuel mix, and the importance of energy security as a driver of future energy policy. It describes the success of demand-side management (DSM) programs in the US and California in particular. Finally, it presents results of DSM programs in Thailand after 29 years of implementation and concludes that there is ample evidence to support the promotion of energy efficiency as the “first fuel” option for Asian energy planners and policymakers.

Keywords: energy efficiency; DSM (demand-side management)

*Corresponding author. Tel.: +66 2 793 4642

E-mail address: pdupont@nexant.com

1. Background: clean energy in Asia

Developing countries are the new battleground for clean energy. The charts in Fig. 1 shows the increases in population, GDP, and primary energy demand in developing countries, relative to developed (OECD) countries. In particular, the chart on the right shows that, as of 2010, the developing countries for the first time accounted for a greater share of global primary energy demand than did developed countries.

It is important to recognize that levels of per capita energy demand are still much higher in developed countries and in newly industrialized countries than in developing countries. Fig. 2 shows primary energy demand per capita: The US uses about twice as much energy per capita as Japan and about 6 to 15 times as much energy per capita as many developing countries in Southeast Asia. In the long-term, in order to stabilize the climate, levels of per capita energy use in developed countries will have to come down substantially, even as per capita levels of developing countries increase. It is important to note that climate stabilization cannot be achieved by fuel substitution with low-carbon fuels alone. It will require reduced intensity of energy use – i.e. lower per capita energy usage.

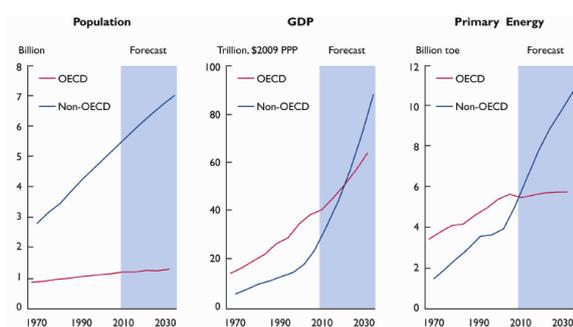


Fig. 1 Trends in Population, GDP, and Energy Demand in Industrialized and Developing Countries Worldwide (BP, 2010).

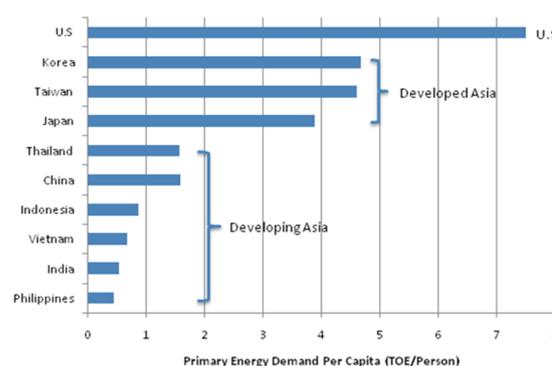


Fig. 2 Primary Energy Demand per Capita, by Country (2008-2030) (USAID 2011).

Business-as-usual scenarios for energy demand in developing Asia demonstrate the challenge faced by clean energy. Fig. 3 shows the predominance of oil, gas, and coal in the planned energy mixes of Southeast Asia, India, and China for the period 2008-2030. Clearly, there will need to be a major shift away from these traditional fossil fuels in order to significantly reduce energy-related CO₂ emissions over the next 16 years.

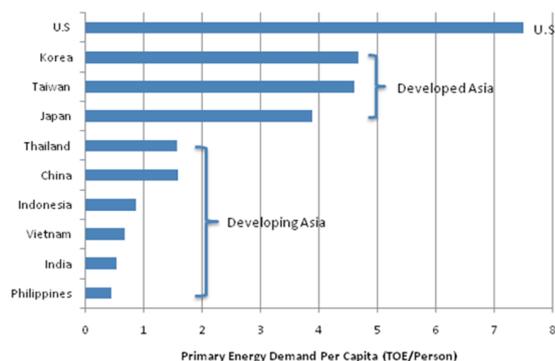


Fig. 2 Primary Energy Demand per Capita, by Country (2008-2030) (USAID 2011).

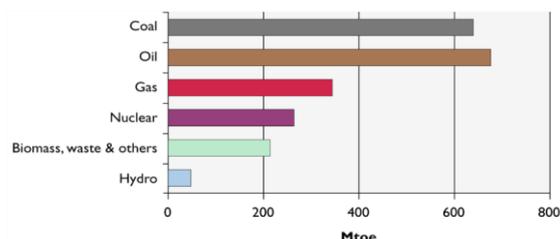


Fig. 3 Incremental Primary Energy Supply by Fuel Type of Southeast Asia, India, and China (USAID 2011)

Fig. 3 also indicates that, even under business-as-usual scenarios, nuclear power, which is often seen as the key no-carbon fuel, will only be the fourth largest source of primary energy. Recent observations of the nuclear industry do not appear to reflect a resurgence, or significant, growth in the overall amount of nuclear generating capacity globally (Schneider 2014). In fact, total nuclear electricity output has been flat or declining—a trend that started before the Fukushima disaster in March 2011 (see Fig. 4).

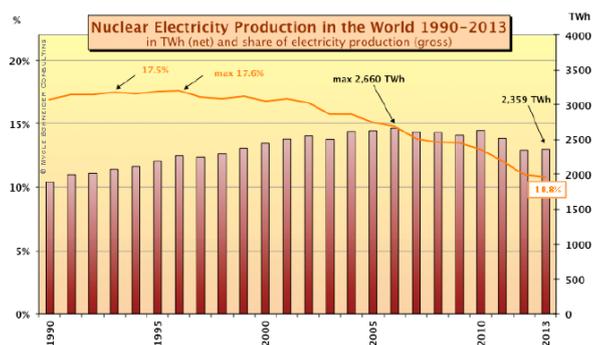


Fig. 4 Nuclear Electricity Production in the World, 1990-2013 (IAEA et al. 2014).

The reality is that for many, if not most, Asian policymakers, energy security is a much stronger driver for action on clean energy than is climate change. The energy security dimension is shown in Fig. 5. Overall, the share of developing Asia’s primary energy demand that will be met by imports is projected to increase from 55 percent in 2009 to 68 percent in 2020 and 83 percent in 2030. (USAID 2011). This increasing reliance on imports will put pressure on the countries’ balance of payments and will also put increasing strain on the sources of global supply, leading to an increase in energy security problems.

2. Energy efficiency policies and programs: the first fuel

The data above demonstrate the rapid growth of energy demand in developing Asia, and—at least under BAU scenarios—the continued reliance on fossil fuels for the vast majority of new energy supply over the next two decades. There is a major gap between climate change scenarios and policies on the ground. Most of the investment and discussion about clean energy in the context of climate change has centered around fuel substitution (i.e. increased use of natural gas) and increased penetration of renewable energy technologies.

Yet the policy prescriptions for mitigation to achieve climate stabilization rely on energy efficiency for the majority of emissions reductions. For example, Fig. 6 shows data from IEA’s World Energy

Outlook indicating that two-thirds (65%) of emissions reductions in 2020 and 57% of emissions reductions in 2030 will need to come from improvements in energy efficiency. Yet clearly, there is a major “Efficiency Gap” – only a small fraction of the needed emissions reductions are currently being achieved from energy efficiency initiatives, due to a lack of emphasis on, and investment in, these initiatives.

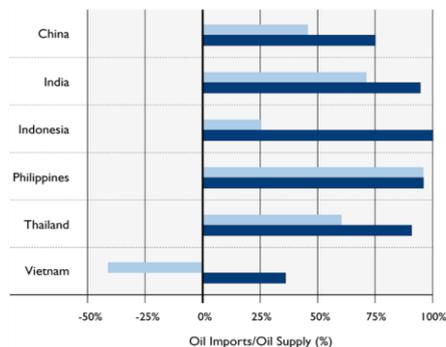


Fig. 5 Trends in Oil Import Dependency in China, India, and Southeast Asia (USAID 2011).

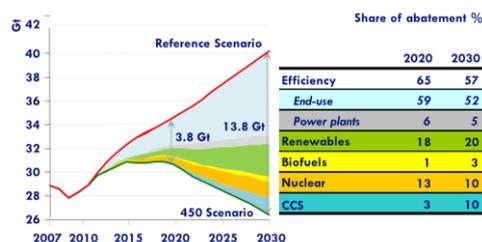


Fig. 6. Actions Needed to Achieve the 450 ppm Scenario in IEA’s *World Energy Outlook* (IEA 2011).

3. Experience with DSM in the U.S.

US electric utilities and related energy efficiency agencies have been implementing demand side management (DSM) programs in the U.S. The average level of spending in the US on DSM initiatives is approximately \$8 billion per year (York 2014).¹

The two charts below show how the U.S. state of California has used both regulations and programs to drive efficiency improvements. Fig. 7 shows that average per-capita electricity consumption in California has fallen relative to average per capita electricity consumption in the U.S. This works out to a net savings of \$1,000 annually per family.

Fig. 8 provides a breakdown of how California has achieved these savings—approximately half through minimum efficiency standards and building codes, and half through utility-based DSM programs.

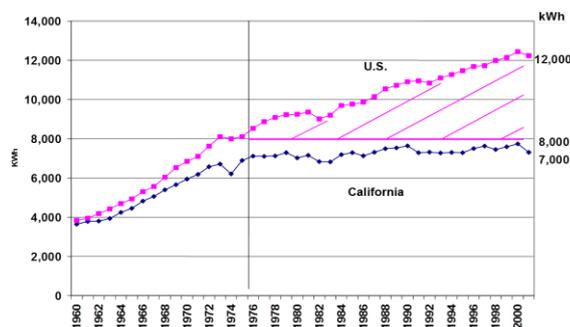


Fig. 7 Electricity Use Trends over Time, in the US and California.

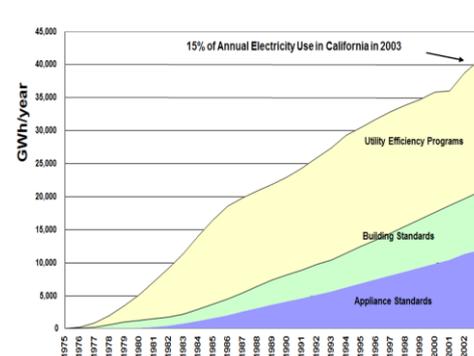


Fig. 8 Breakdown of How California has Achieved its Energy Savings.

4. Case study: Thailand’s seven (5) conservation power plants

Thailand drew on inspiration from US experts in the late 1980s to begin considering DSM as a strategy for managing demand, and in November 1991 passed a landmark demand-side management master plan (Cherniack and du Pont, 1991). The Thailand DSM Office was established and launched in 1994, and the first initiative was a nationwide transformation of fluorescent “fat” (T-12)

¹ This Fig. excludes budgets for load management and demand response programs.

to “thin” (T-8) lamps. Subsequent programs focused on labeling of appliances such as air conditioners and refrigerators. Later, a variety of home appliances such as fans, rice cookers, and water heaters were added.

Table 1 Summary of Thailand DSM Results: 1995-2014 (EGAT 2014).*

Program	MW	GWh	CO ₂ (Ton)
Lighting	1,114.5	6,210.5	3,692,608
Refrigerator	721.7	4,274.4	2,721,578
Air Conditioner	1,449.9	9,452.8	5,356,183
Other Equipment**	190.5	788.9	405,124.5
Total	3,477	2,0727	12,175,493

* Through 30 September 2014

** “Other equipment” includes fans, rice cookers, electric motors, TVs, computer monitors, electric kettles, and water heaters.

Table 1 shows the results from 20 years of implementation in Thailand. The peak reduction in September 2014 reached nearly 3,500 MW, or the equivalent output of approximately seven, 500 MW thermal power plants. In other words, Thailand has constructed seven “conservation power plants.”

Fig. 9 shows a comparison of the capital and generating cost for different supply options for the Thai power sector. It demonstrates that DSM and energy efficiency are the most cost-effective resource for Thailand’s power sector.

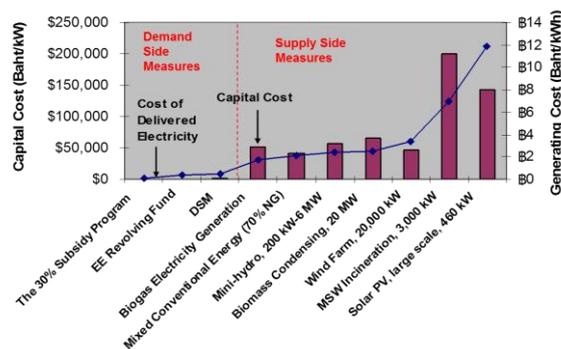


Fig. 9 Cost Comparison of Energy Options in Thailand (du Pont et al. 2004).

Table 2 shows the cost effectiveness of these programs. The average budget for the program has been in the range of \$8-10 million per year. The expenditures have been relatively low because the program has relied on voluntary cooperation with manufactures and labeling of appliances, and extensive information campaigns, with relatively little budget for financial incentives.²

Table 2 Cost Effectiveness of Thailand’s DSM Programs (EGAT 2014).

Program	Thai Baht	USD
Estimated Total DSM Expenditures to Date	THB 4.862 billion	\$148.4 million
Cost of Peak Demand Saving	THB 1,398/kW	\$42/kW
Cost of Saved Electricity	THB 0.23/kWh	0.7 cents/kWh

* Through 30 September 2014

² Another Thai agency, the Department of Alternative Energy Development and Efficiency (DEDE) has implemented a number of financial incentive programs for factories and buildings.

5. Conclusion

The results after 20 years of implementation of DSM in Thailand are consistent with the results from the United States. It has been proven that electricity efficiency programs, if implemented and monitored properly, can deliver energy savings and peak demand savings at a fraction of the cost of traditional fossil fuels. Give this clear and compelling evidence, Asian policymakers and planners in the power sector should seriously consider allocating budgets to demand-side programs, where they can get more “bang for the buck”.

6. Acknowledgements

The author would like to thank Napaporn Phumaraphand, former Director, Planning & Evaluation of the Thailand DSM Office, for providing input on the Thai DSM results.

7. References

- BP. 2010. Energy Outlook 2030. London: British Petroleum [Online]. Available at: www.bp.com.
- Cherniack, Mark and Peter du Pont. 1991. Demand Side Management for Thailand's Electric Power System: Five-Year Master Plan. Bangkok: Prepared by the International Institute for Energy Conservation, for the Thailand's electric utilities. November
- du Pont, P, Sirinthorn Vongsoasup and Prasert Sinsukprasert. 2004. An Energy-Efficiency Promotion Strategy for Industries and Buildings in Thailand. Paper presented at the Industrial and Commercial Use of Energy Conference, Capetown, South Africa. 10-11 May.
- EGAT (Electricity Generating Authority of Thailand). 2014. Bangkok: Data on DSM results provided by DSM Office. September.
- IAEA et al. 2014. The World Nuclear Industry Status Report 2014. International Atomic Energy Agency-Power Reactor Information System, British Petroleum, and Mycle Schneider Consulting [Online]. Available at: <http://www.worldnuclearreport.org/WNISR2014.html>.
- IEA. 2011. World Energy Outlook. Paris: International Energy Agency.
- NRDC. 2010. San Francisco: Natural Resources Defense Council. Blog by David Goldstein [Online]. Available at http://switchboard.nrdc.org/blogs/dgoldstein/some_dilemma_efficient_applian_1.html.
- USAID. 2011. Energy Trends in Developing Asia: Priorities for a Low-Carbon Future. Bangkok: US Agency for International Development, Regional Development Mission for Asia.
- York, D. 2014. Current Status and Trends of DSM in North America. Presentation at Deep Dive Workshop on Utility-Based DSM at Asia Clean Energy Forum. 19 June 2014.