

## Seminar on “Supplying Energy through Greater Efficiency”

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### Introduction

Dr Meier began the seminar by introducing the demand-side perspective of the energy equation. He explained that, for every unit of energy supplied, a unit of energy was also consumed, i.e., supply equals demand. While most people focused on increasing energy supply during an energy crisis, it was equally important and effective to reduce the demand for energy.

Dr Meier commented that one reason why people often focused only on the supply side of the equation was that they assumed that energy demand could not be changed. They were often mistaken, as there was in fact much potential to improve energy efficiency, which would greatly reduce the energy required to provide the same level of services.

### Benefits of Energy Efficiency

Dr Meier noted that the benefits of energy efficiency included higher economic competitiveness, increased energy security and reduced pollution. Businesses which were more energy efficient would have lower operating costs and hence be more competitive. This was important particularly for companies in Singapore, where energy prices were higher than that in other countries like Australia. In addition, new markets could be created as companies demanded more energy efficient products.

Referring to the McKinsey study on the cost of abatement of CO<sub>2</sub>, Dr Meier remarked that energy efficiency measures often provided net economic benefits, rather than cost. Many of these measures could lead to 20% to 30% in long term energy savings.

In terms of energy security, Dr Meier noted that a lower demand for energy would reduce the country's reliance on risky sources of energy. It would even imply that a higher proportion of energy could be generated by renewable sources. As for pollution, Dr Meier explained that a lower demand for energy would lead to lower pollution and emission of greenhouse gases. It could also mitigate the urban heat island effect in Singapore.

### Types of Energy Savings

Dr Meier classified energy savings into three categories:

1. *Direct energy savings.* These were often achieved through technological improvement leading to better insulation in buildings, more efficient air-conditioning systems, lower standby power in electrical appliances, etc.
2. *Indirect energy savings.* For example, more efficient light bulbs generated less heat when producing light. This would reduce the heat load and hence energy consumed by the air-conditioner.
3. *Change the rules.* This involved changing the manner in which services were provided. For example, waste heat would be reduced if water was heated using a

microwave oven instead of a conventional stove. Energy was lost at each stage of heat transfer, from the heated stove to the kettle and then the water. The microwave oven, on the other hand, directly transferred heat energy to the water.

### **Areas with Potential for Significant Energy Savings**

Dr Meier highlighted areas in which there were significant energy saving opportunities. In automobiles, for instance, about 20% of the fuel consumed was used to overcome road resistance of tyres. If tyres were designed with less road resistance, but still sufficient to ensure safety while driving, vehicle fuel consumption could be significantly reduced. In fact, among the range of tyres available in the market, road resistance could vary by as much as 25%. However, manufacturers typically did not reveal the road resistance of their tyres, and this lack of information prevented consumers from selecting tyres with less road resistance.

Another area was the electricity consumption of refrigerators. About 12% of the electricity consumed in the US was generated from hydropower. A similar percentage was consumed by refrigerators. To meet increasing electricity consumption by refrigerators, the US could build more hydroelectric dams. However, this was limited by the number of rivers suitable for hydropower, as well as other environmental concerns related to dams disrupting river flow. An alternative was to reduce the efficiency of refrigerators so that they consumed less electricity. Building more efficient refrigerators was also often much cheaper than building new hydroelectric dams.

Motors were another type of equipment that consumed much energy—more than 60% of the US' total electricity consumption. Dr Meier suspected that the situation was similar in Singapore, given the common use of motors in many appliances and equipment, from water pumps and air-conditioning systems to ICT equipment. Hence, much energy could be saved if more attention was paid to producing and using more efficient motors.

Standby power was another common source of energy wastage. Most appliances entered standby mode when switched off using the remote control. Unknown to the consumer, these appliances continued to draw power even when it was “switched off”. Although the standby power consumption of each appliance was usually small, when aggregated across all the appliances in a home, the amount would be significant. In California, 13% of residential electricity use was due to standby power. In Japan, the figure was about 9% to 10%. Dr Meier estimated that it would be about 20% in Singapore.

Dr Meier commented that the greatest source of standby power consumption in a Singaporean home was probably the cable TV set top box, which could consume as much electricity over the year as a new refrigerator. Besides drawing power even when the TV was switched off, the set top box also generated a lot of heat, increasing the electricity consumed by the air-conditioner to cool the house.

Residents often did not have control over the energy efficiency of the set top boxes in their homes. This was determined by the cable TV service provider, whose interest was in keeping the capital cost of set top boxes low, not in saving energy for consumers. The boxes were required for the cable TV services, and consumers had no choice over which type of set top boxes to use. This was an example of the principle-agent problem.

Another example of the principle-agent problem was vending machines. They were operated by service providers who did not pay the utility bills; the utility bills were paid by owners of the premises hosting the vending machines.

### **Effectiveness of Energy Efficiency Policies in Other Countries**

Although the effectiveness of energy efficiency policies was often invisible (unlike infrastructural energy supply projects like coal plants, nuclear power plants, hydroelectric dams, etc.), Dr Meier noted that they were effective. Citing California as an example, Dr Meier said that the per capita energy consumption in California had remained fairly constant since the 1970s, even while its economy grew at 10% per annum. In comparison, the per capita energy consumption of the US as a whole increased over the same period. The energy consumption in Texas increased at an even higher rate.

Dr Meier explained that California was able to achieve a slower rate of growth in energy consumption through aggressive energy efficiency policies, including demand side management by utility companies, energy efficiency programmes spearheaded by the government, etc. For example, California was the first state to incorporate comprehensive energy efficiency requirements in new buildings. Texas, on the other hand, did not have any building standards. Dr Meier added that California was now exploring new approaches to energy efficiency policies, challenging itself to not only maintain constant per capita energy consumption, but to reduce this in future years.

Denmark was another country which managed to achieve economic success with no increase in energy use. It had reduced its total absolute energy consumption since 1975. Dr Meier noted that Denmark's population size was similar to that of Singapore, and that the population had not been worse off due to Denmark's energy efficiency measures. On the contrary, most people found Denmark an attractive place to live in.

### *Energy Efficiency Standards*

Dr Meier shared that a survey by the International Energy Agency (IEA) of energy efficiency policies in various countries found that energy efficiency standards and building codes were among the most cost effective and successful energy efficiency programmes. For example, due to energy efficiency standards in countries like Japan, Denmark and Australia, air-conditioners were now able to provide two to three times as much cooling power using the same amount of electricity. The situation was similar for most refrigerators in Japan, the EU and US. Many other appliances used half or even a third as much electricity as they did 20 years ago.

Dr Meier explained that any higher costs involved in complying with the energy efficiency standards were often recovered through the energy savings reaped over the lifetime of the appliances or buildings. Most manufacturers also did not face significant obstacles in complying with the standards. However, with regard to appliances, Singapore was in a different situation as we did not manufacture the appliances but imported most of them. Dr Meier felt that this was an advantage for Singapore, as we did not need to worry about whether domestic manufacturers could comply with new standards, and could therefore "shop" around for the most stringent standards among different countries.

Dr Meier noted that standards not only removed the most inefficient appliances from the market. It also helped to address principle-agent problems, a market failure in which the party paying for higher upfront capital cost of energy efficient equipment did not enjoy the

resultant long term energy savings. To encourage energy users to surpass the standards, or to help new more efficient technologies to gain a foothold in the market, subsidies and rebates could help grow market demand, increase competition among suppliers and eventually drive prices down.

### *Energy Labelling*

Dr Meier noted the importance of providing sufficient information to consumers, to ensure a more efficient market and demand for energy efficient equipment. This could be achieved through energy labelling for appliances, houses, commercial buildings, etc. Studies in the EU also showed that energy labels were effective in causing a significant shift in the purchasing patterns or sales of appliances. As energy labels became more widely used, consumers began to purchase more efficient products. It was uncertain to what extent this effect was caused by consumers demanding for more efficient products, or by manufacturers producing more efficient products for branding purposes. Regardless, the point was that the aim of improving energy efficiency was achieved.

Dr Meier remarked that different countries adopted different designs for the energy labels. He cautioned that the energy labels should be designed in a way which clearly communicated to consumers the energy savings/use of the appliance, and not confuse them. He cited the example of the Canadian EnerGuide energy label, which indicated the energy consumption of labelled appliances; 30% of consumers thought the figure referred to energy savings instead, resulting in them purchasing the most energy inefficient equipment.

### *Public Education*

Dr Meier shared that crises such as temporary electricity shortages in some countries had motivated them to embark on aggressive energy efficiency public education campaigns. One example was Brazil which depended on hydropower for its entire energy demand. A drought in 2001 led to a national emergency as Brazil's electricity supply was severely affected. The country embarked on a programme mandating 20% year-on-year reduction in electricity consumption. Anyone who did not meet this requirement would have their electricity supply disconnected. Besides a huge media campaign to encourage change in behaviour, this requirement also motivated firms to replace existing equipment such as cooling systems with more efficient ones.

A similar crisis occurred in Tokyo in 2003, when it was forced to shut down all its nuclear power plants; these plants contributed to 40% of Tokyo's electricity generating capacity. There were fears that increased electricity demand for cooling purposes during the summer would further exacerbate the energy shortage. Intensive energy efficiency campaigns were implemented, with advertisements, featuring endorsements from public personalities, providing consumers with practical information and energy saving tips such as reducing standby power consumption. Tokyo eventually achieved a 4.5% in energy savings, and avoided any blackouts that summer.

Dr Meier gave a third example, that of Juneau, the capital of Alaska. With a population of 30,000, Juneau obtained 90% of its electricity from a single hydroelectric dam. When an avalanche cut the transmission line from the dam to the capital, backup diesel generators were used as a temporary measure to boost the electricity supply for Juneau. Electricity prices also increased five times as a result, from \$0.11 to \$0.50 per kWh.

In response to the Juneau city government's request, Dr Meier's team from the Lawrence Berkeley National Laboratory came in to help launch an energy conservation campaign. The campaign focused on mobilising the community to teach people how to save electricity, e.g. pulling the plug off the switch when appliances were not in use. Dr Meier's team also found that the airport, two sewage treatment plants and three water treatment plants consumed a significant proportion of Juneau's energy. Hence, the public education campaign taught people to not only save electricity, but also water, which indirectly led to savings in electricity for Juneau as a whole. The campaign was successful and resulted in a 40% reduction in electricity use in six weeks.

Apart from print advertisements, the use of other media such as video advertisements was also important in getting the energy efficiency message across and mobilising the public. He showed examples of videos produced by Norway, which were created to catch the public's attention and ensured that the message of saving energy remained at the forefront of public consciousness. New Zealand's print advertisements relied on humour and concise messaging to communicate the need for "vigilance, sacrifice, and education" to realise energy savings.

### **Conclusion**

Dr Meier ended the seminar by concluding that, in any energy strategy, it was important to consider both the demand and supply of energy. Significant savings could be achieved when energy demand was reduced. He also explained that, over the long run, it was important to price energy correctly and to adopt new energy efficient technologies, to achieve sustained energy efficiency improvements. It was not sustainable to rely on occurrences of energy crises to get people to adopt energy efficient equipment and habits.