

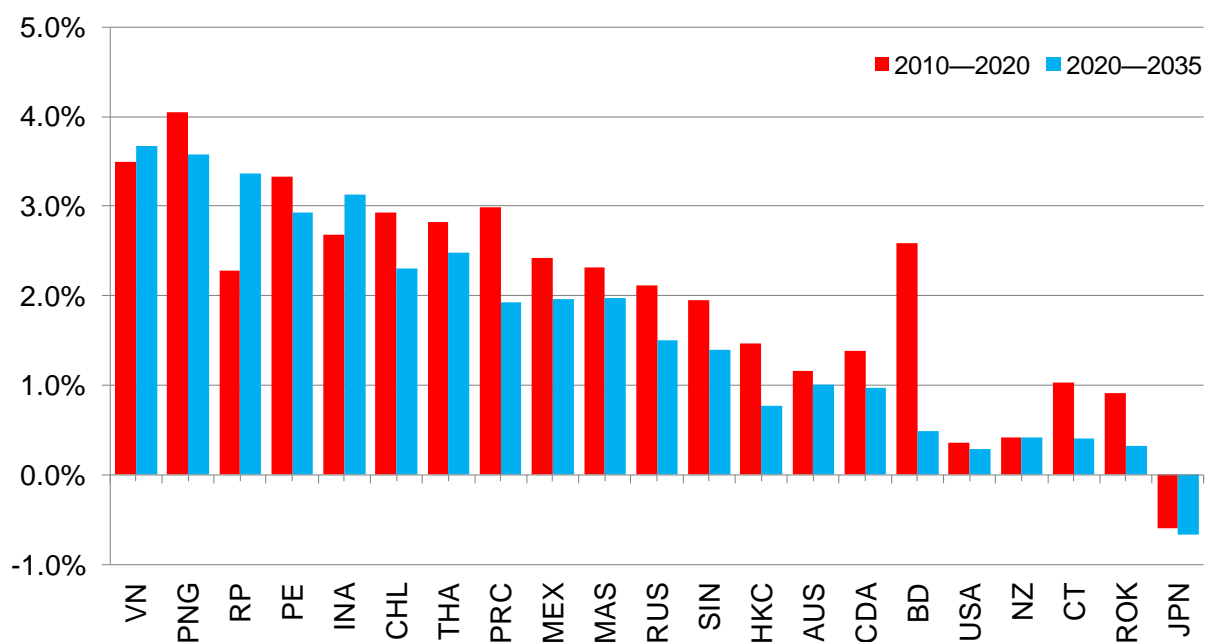
# 4 FINAL ENERGY DEMAND

## TOTAL FINAL ENERGY DEMAND

The projected APEC final energy demand will increase over the outlook period from 4758 Mtoe in 2010 to 6861 Mtoe in 2035. This represents an increase of 44%, and an average annual growth rate of 1.5% between 2010 and 2035.

Figure 4.1 shows the growth rates by economy for the periods 2010–2020 and 2020–2035. As one would expect, the developing economies tend to have the faster growth rates, while final energy demand in the developed economies grows more slowly or, in the case of Japan, actually declines.

Figure 4.1: Annual Percentage Growth Rates in Final Energy Demand by Economy



Source: APERC Analysis (2012)

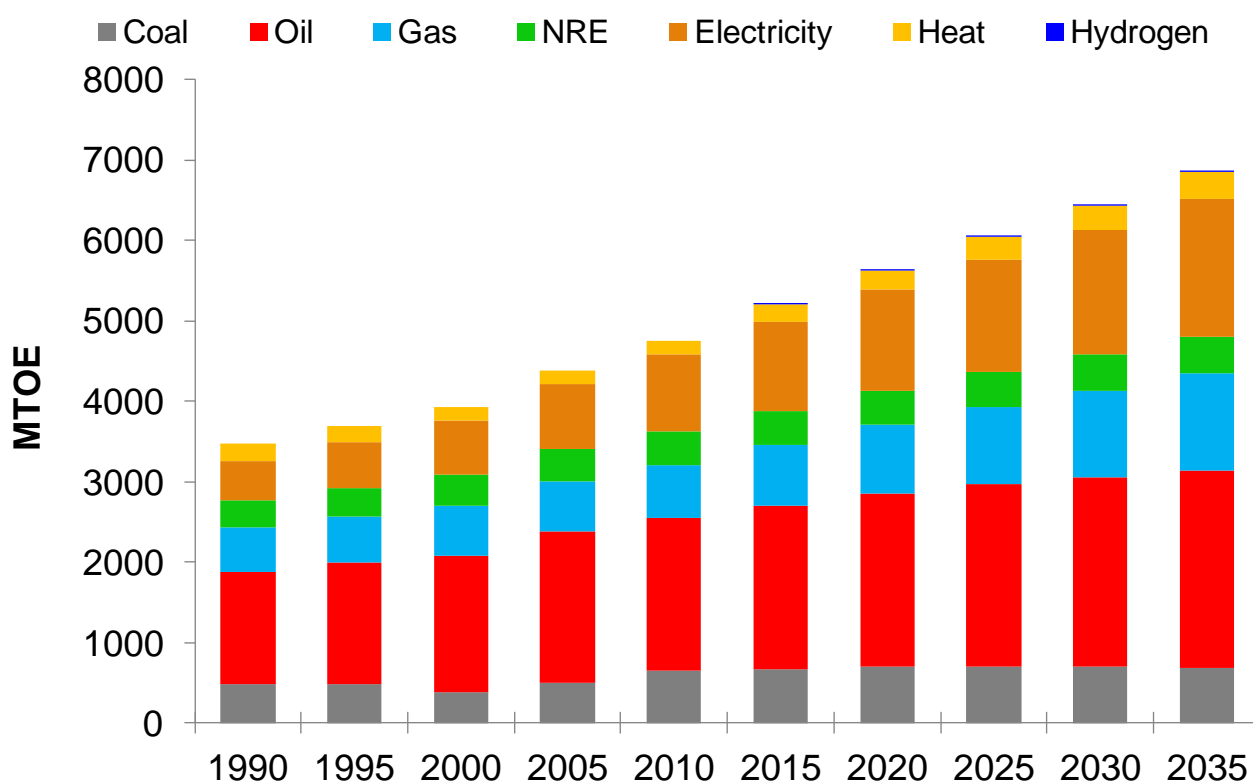
### Final Energy Demand by Energy Source

Figure 4.2 shows the total APEC final energy demand by energy source. Figures 4.3 and 4.4 show these results broken out by economy. Note the difference in the vertical axis scales for the latter two figures.

Figures 4.3 and 4.4 show that China and the US will dominate the final energy demand in the APEC region: together they will account for more than 60% of the APEC final energy demand in 2035. China's final energy demand had already overtaken that of the US in 2010, and it is projected to grow at a rate of 2.3% over the 2010–2035 period, compared to 0.3% for the US.

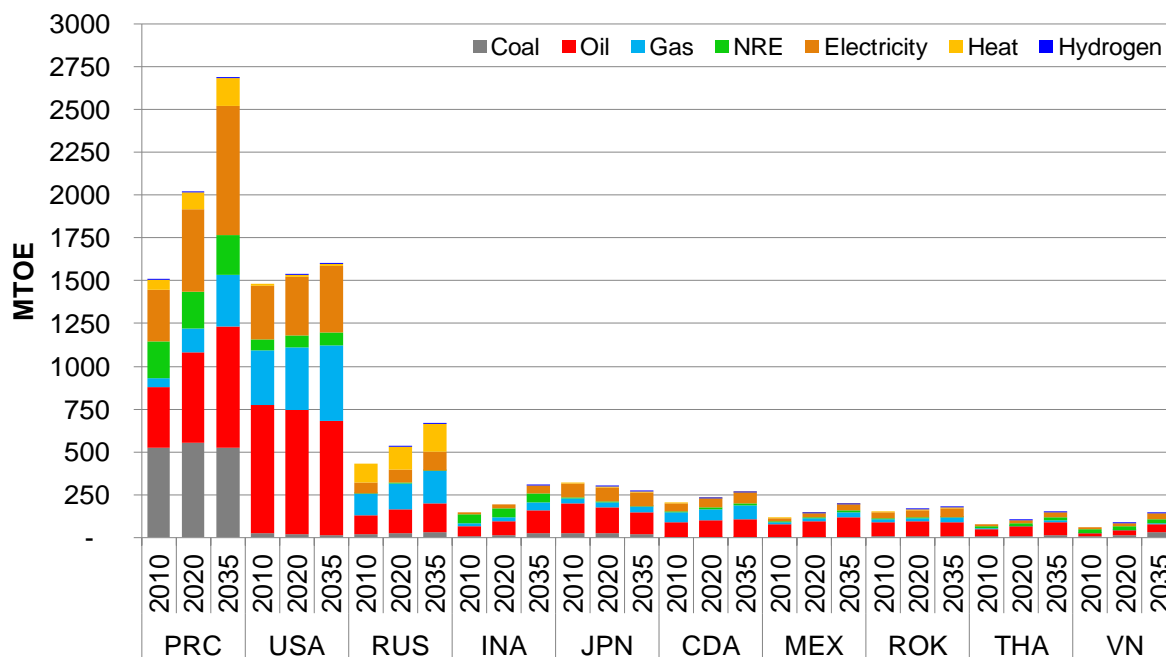
China will also clearly dominate the final demand for coal in the APEC region, accounting for about 76% of the APEC region's final coal demand in 2035. (Note that final demand for coal excludes the demand for coal in power plants, which will be much more widely distributed across the APEC economies.) The US has historically dominated demand for oil in the APEC region, accounting for about 40% of the region's final oil demand in 2010, but by 2035, China's demand for oil will slightly exceed that of the US; at that time, China's share of APEC oil demand will be 28% while the US share will be 27%.

Figure 4.2: APEC Final Energy Demand by Energy Source



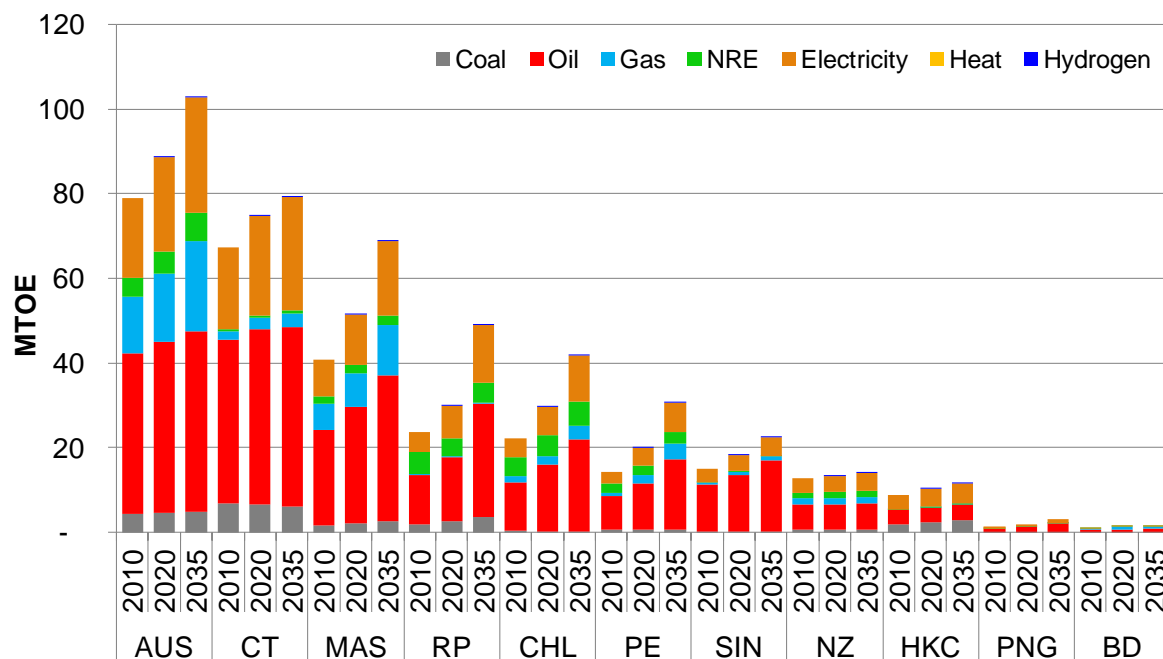
Source: APERC Analysis (2012)

Figure 4.3: Final Energy Demand by Energy Source, Higher Final Demand Economies



Source: APERC Analysis (2012)

Figure 4.4: Final Energy Demand by Energy Source, Lower Final Demand Economies



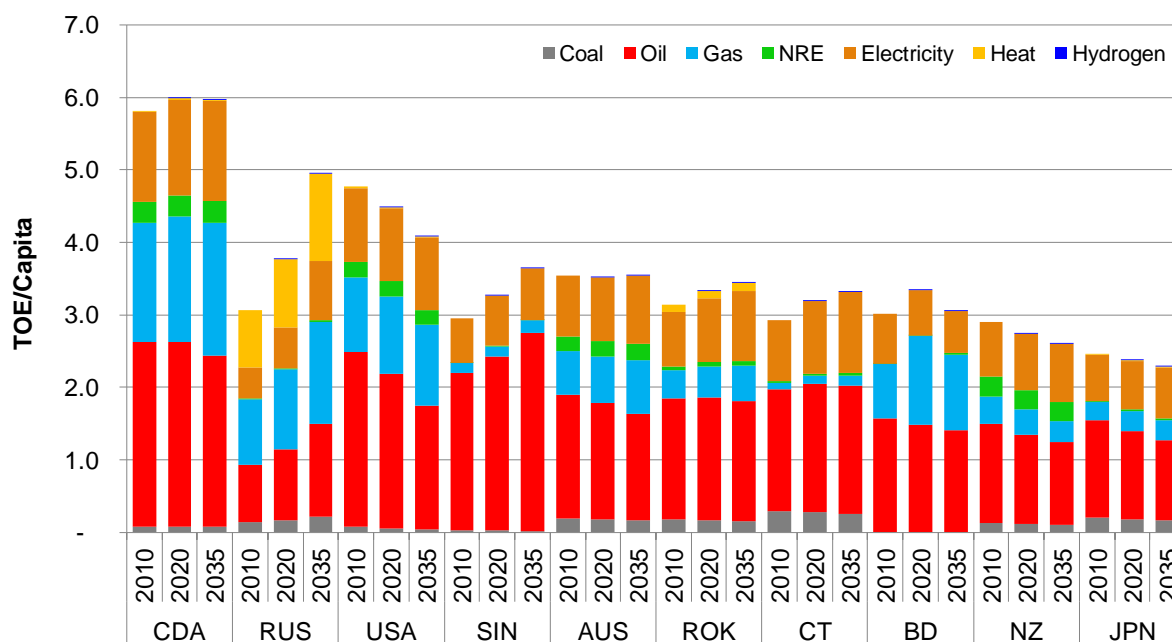
Source: APERC Analysis (2012)

Figures 4.5 and 4.6 show the final energy demands by energy source on a per capita basis. Again, note the differences in the vertical axis scale between the two figures. There are stark differences in final energy demand per capita between the economies with the highest per capita demand and the economies with the lowest per capita demand. Naturally, per capita consumption tends to be highest in the developed economies and lowest in the developing economies. Some developing economies

are projected to show large increases in per capita final energy demand.

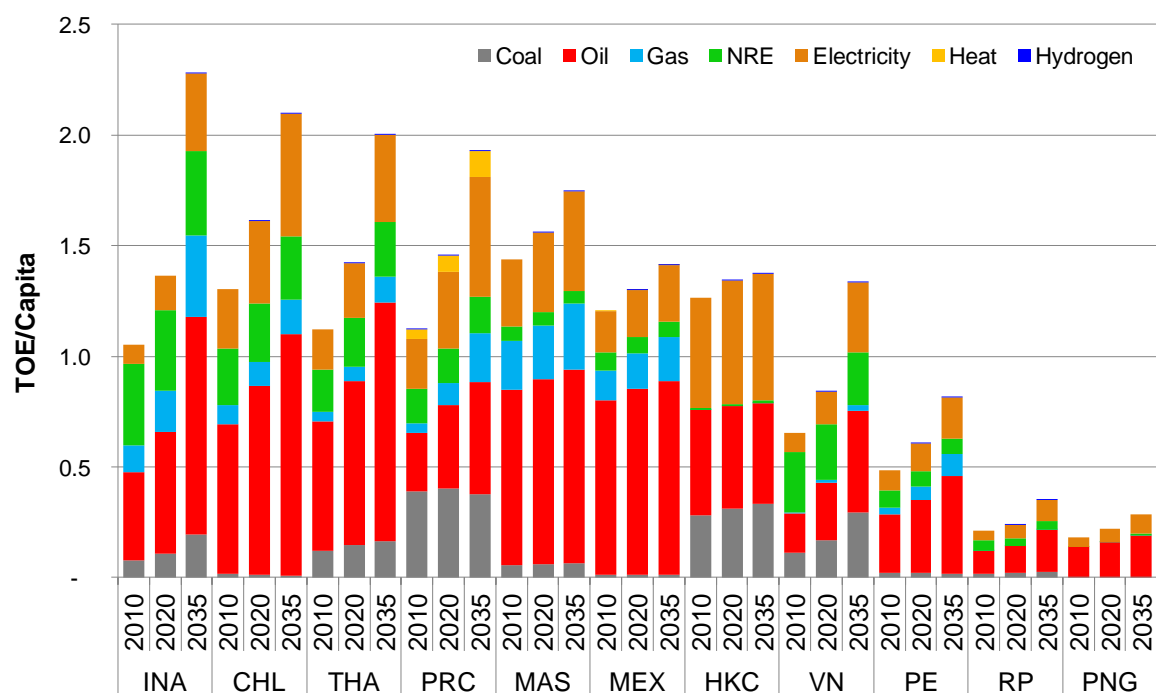
There is little that can be said in general regarding the differences in per capita use of various energy sources between economies, except that the developed economies tend to use more of just about every energy source. The notable exception is new renewable energy (NRE), which tends to be more heavily used in developing economies, in the form of biomass used in the residential sector.

Figure 4.5: Final Energy Demand by Energy Source Per Capita, Higher Final Demand per Capita Economies



Source: APERC Analysis (2012)

Figure 4.6: Final Energy Demand by Energy Source Per Capita, Lower Final Demand per Capita Economies



Source: APERC Analysis (2012)

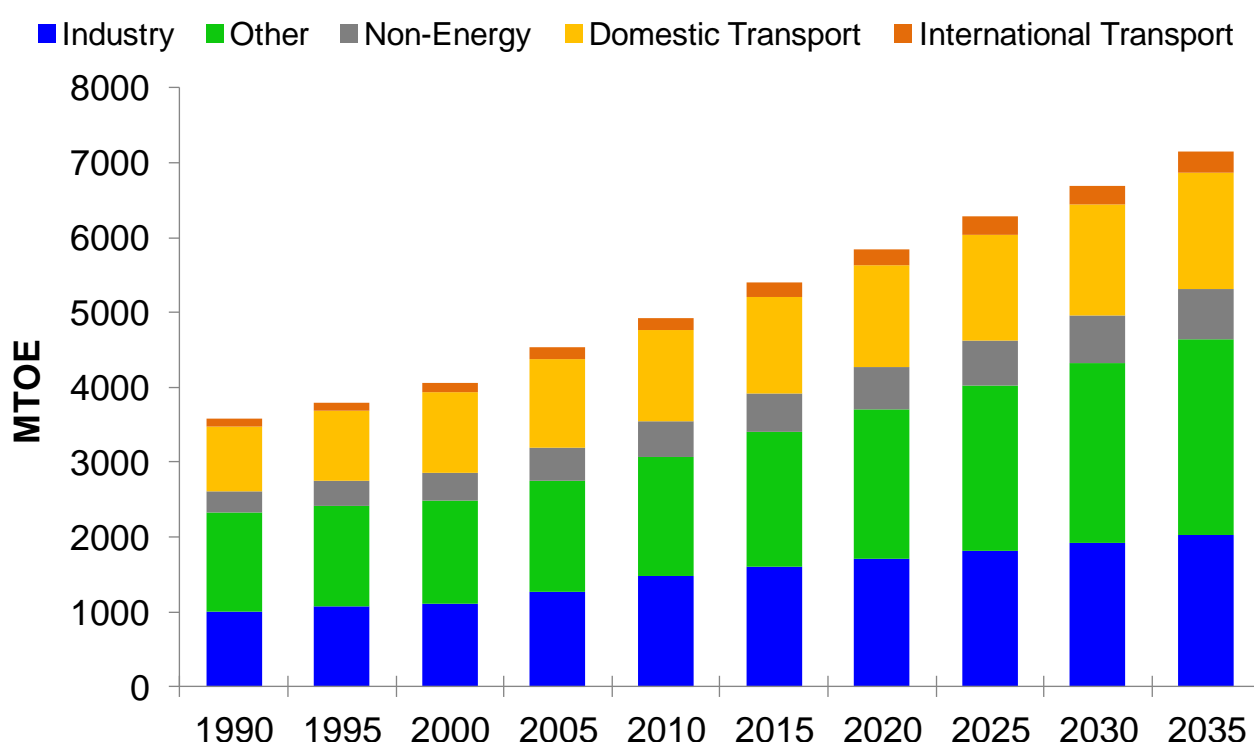
### Final Energy Demand by Sector

Figure 4.7 shows the total APEC final energy demand by sector. Figures 4.8 and 4.9 show these results broken out by economy. Figures 4.10 and 4.11 show the same results on a per capita basis. These sector figures include the international transport sector, which was not included in the final energy demand by energy source figures above. Under International Energy Agency (IEA) statistical conventions, international transport is not considered part of an economy's final demand, presumably because it is not necessarily consumed within the economy's borders. Singapore and Hong Kong,

China have disproportionately large demands for international transport energy, due to their roles as major international shipping and air transport hubs. Without this international transport demand, they would otherwise rank in the mid range of the APEC economies in per capita energy demand.

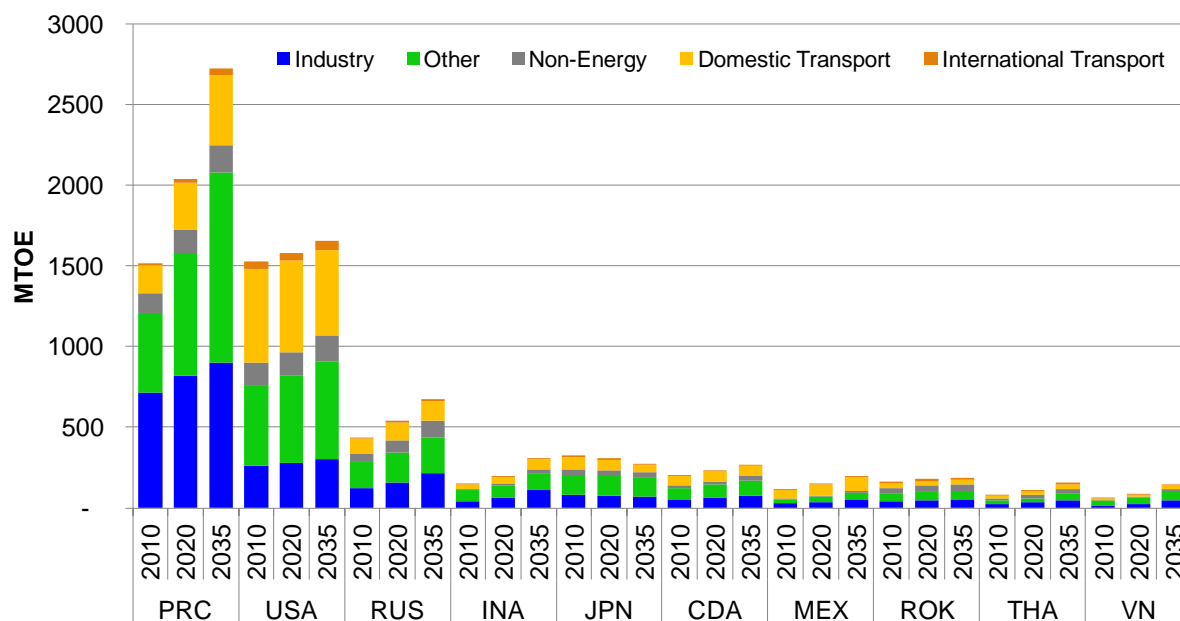
In general, developed economies tend to use more energy in every sector. Transport demand tends to be especially large in the developed economies and, not surprisingly, non-energy use tends to be largest in economies that have large refinery industries.

Figure 4.7: APEC Final Energy Demand by Sector



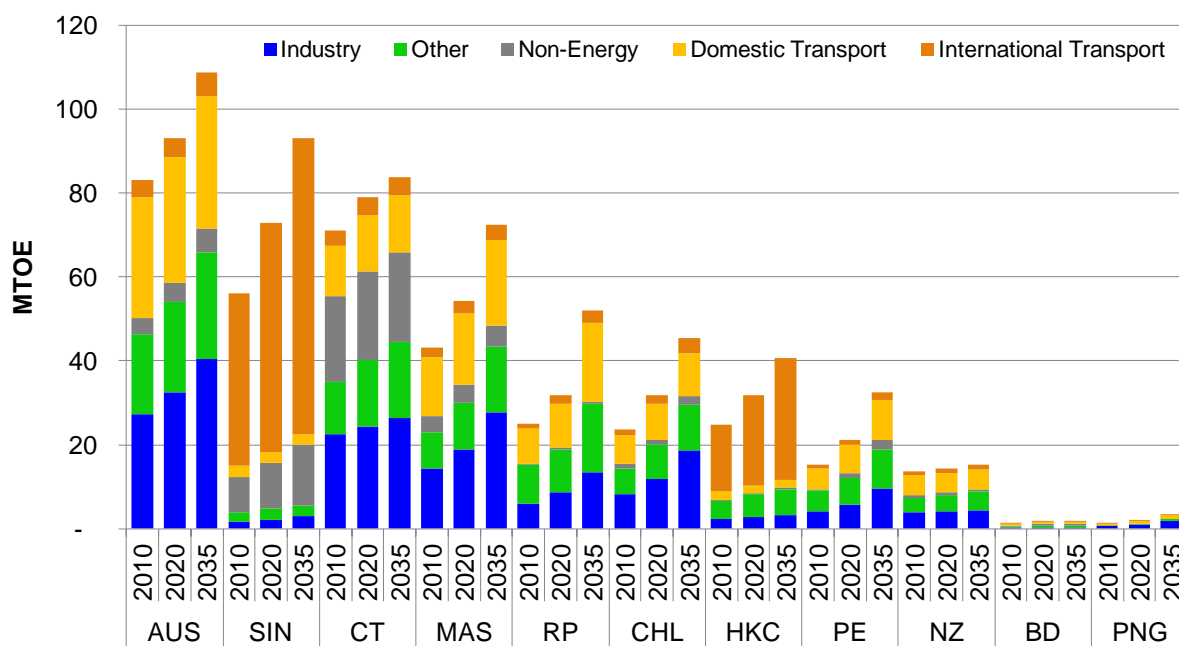
Source: APERC Analysis (2012)

Figure 4.8: Final Energy Demand by Sector, Higher Final Demand Economies



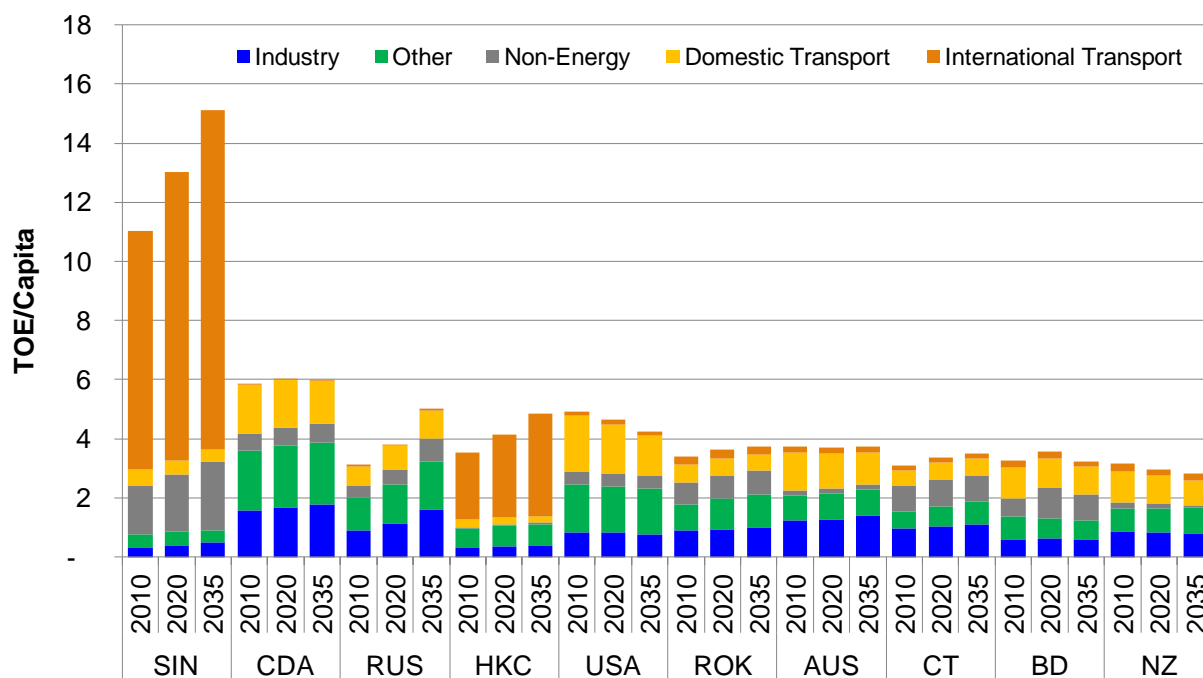
Source: APERC Analysis (2012)

Figure 4.9: Final Energy Demand by Sector, Lower Final Demand Economies



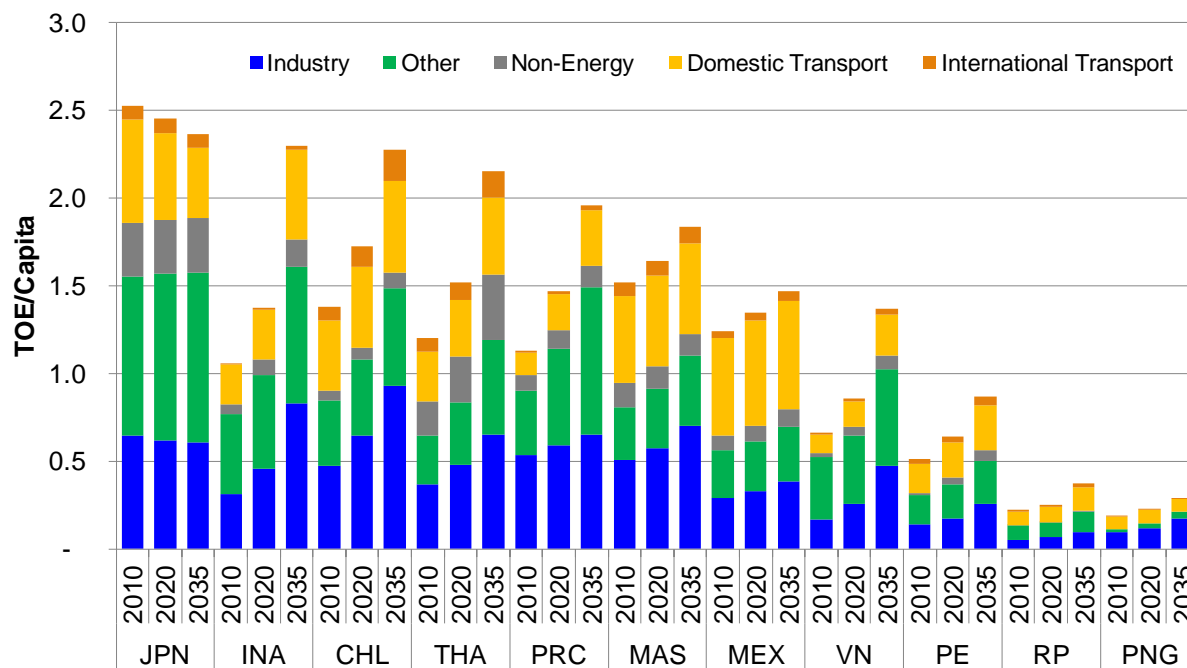
Source: APERC Analysis (2012)

Figure 4.10: Final Energy Demand by Sector Per Capita, Higher Final Demand per Capita Economies



Source: APERC Analysis (2012)

Figure 4.11: Final Energy Demand by Sector Per Capita, Lower Final Demand per Capita Economies



Source: APERC Analysis (2012)

## MARKET FAILURES AND ENERGY EFFICIENCY

Chapters 5–8 discuss the energy challenges and opportunities in specific energy-using sectors. Before examining specific sectors, however, it is appropriate to examine the challenges and opportunities presented by energy demand in general. The key message of the remainder of this chapter, is that there are many opportunities to improve the efficiency with which energy is used. These opportunities should be viewed as equal in significance to measures on the supply side for achieving a more sustainable energy future.

At first glance, saying that there are many opportunities to improve energy efficiency does not sound like a particularly useful insight. After all, by ‘working smarter’ (such as better planning, better engineering, or improved technology) the efficiency of virtually every economic activity could be, and probably will be, improved. But the key point of this section is that the opportunities to improve energy efficiency are particularly large and often obvious because *energy demand is different* from other economic activities.

In the case of energy demand, there are strong economic barriers that tend to deter people from ‘working smarter’. The result is that there are many actions that energy users could take to improve energy efficiency that do not get taken, even though they would be economic from the perspective of society as whole. These actions do not get taken because they are not economic, or perhaps not even possible, from the perspective of the energy user. Before we can improve energy efficiency, we need to address the *market failures* that cause the behaviour of energy users and the interests of society as a whole to diverge.

### The Market Failures

There are at least four kinds of market failures that lead to energy inefficiency.

1. *Lack of information.* Energy users generally want to compare the energy efficiency of the options they face, but may be unable to do so due to lack of information. This may occur in several ways:

*Lack of data.* Energy users shopping for a place to live, a vehicle or an appliance, may want to compare the energy efficiency of the various alternatives, but are unable to do so due to a lack of reliable data.

*Lack of skills.* Most consumers are not engineers, and may find the calculations involved in

comparing options with different upfront and ongoing costs to be difficult or beyond their capabilities. Even large organizations may not have engineers with knowledge of the latest technologies for improving energy efficiency.

*Lack of time.* Even those energy users who have the skills to compare alternatives may not have the time to actually perform the analysis.

2. *Split incentives.* The lack of information described above can frequently be compounded by the fact that the person who makes a decision that affects energy use is not the person who pays the resulting energy costs. Consequently, the decision that gets made is not the correct one from the perspective of society. Some examples:

*Landlord/tenants.* The landlord generally pays the cost of energy-efficiency improvements in apartments and offices. The tenant, however, typically pays the energy bills, and thus receives the benefits of these investments.

*Building developers/buyers.* The developer pays the cost of features to enhance energy efficiency in buildings, but the ultimate buyer receives the benefits.

*Internal organization.* In many governments and companies, the administrative unit that manages the capital budget is not the administrative unit that manages the operating budget. Each may seek to minimize their own costs without regard to the impact on the overall organization.

*Free energy.* In some situations, customers are not expected to pay separately for the energy they use. Hotel guests, for example, have no incentive to limit their use of air conditioners, heaters, hot water, and lights.

3. *Underpricing of energy.* In most parts of the world, energy is underpriced relative to its real costs to society. Consequently, energy users have less incentive to improve the efficiency of their activities than would be socially optimal. Some examples:

*Externalities.* In most economies, the energy price typically includes the costs of producing the energy, but not the costs of its adverse impacts on the environment, including greenhouse gas emissions and local pollution.

*Subsidies.* In some economies, energy is explicitly subsidized, so its price does not even cover the full costs of production.



4. *Financing constraints.* Energy users may wish to make an investment that would improve their energy efficiency, but lack the capital or the access to financing that is required. This is a particular problem not only for low-income consumers, but also in the public and non-profit sectors (such as schools, hospitals, and municipal governments), where capital budgets are often tightly constrained.

### The Policy Remedies

Improving energy efficiency is generally a very attractive approach, both politically and economically, for creating a more sustainable energy future. Because of the market failures outlined above, energy efficiency improvements offer a unique opportunity to protect the environment, help the economy, and save money for energy users all at the same time.

The policy prescriptions for improving energy efficiency generally, will directly address the market failures outlined above.

1. *Provide better information.* This may take the form of requiring labels or ratings on appliances, vehicles, and residential/commercial buildings. Ideally, the labels or ratings should be easily understood by people with limited technical training and/or limited time (APEREC, 2010 and APERC, 2011). Websites can also be useful in promoting public education and making information available on energy-saving products and technologies.
2. *Set minimum energy efficiency standards for appliances, vehicles, buildings, and commercial/industrial equipment.* As long as the standards are set at a level that energy users would choose for themselves if they had the option to choose, then both energy users and society will be better off. These standards should include active devices to help energy users monitor and reduce waste, such as devices to shut off the heat and air conditioning in unoccupied hotel rooms. See the further discussion of energy efficiency standards and labeling, as well as building energy efficiency codes and labeling, in Chapter 8.
3. *Raise the price of energy to reflect its full costs to society.* This should include putting a price on carbon in some fashion (such as a carbon tax or emissions trading) as well as additional charges to cover the costs of local pollution and other environmental damage, related to energy production and use. In those economies that subsidize energy, the subsidies should be rationalized and phased out as quickly as possible, while protecting those energy

consumers who are truly in need (see the sidebar in Chapter 10 ‘APEC’s Goal to Rationalize and Phase Out Fossil Fuel Subsidies’).

4. *Ensure that financing is available for cost-justified energy efficiency investments.* These investments will provide benefits that exceed their costs. Therefore, given proper legal and regulatory frameworks, there should be little risk to the lender and little cost to the taxpayer.
5. *Promote energy service companies.* Energy service companies (ESCOs) can provide a total solution for large energy users wishing to improve their energy efficiency. Such a company has engineers trained to identify opportunities for energy saving and to propose appropriate energy-saving investments. Once appropriate investments are identified, the ESCO can provide the necessary financing, manage the implementation, and provide subsequent maintenance. The ESCO can often do all this in return for a share of the energy cost savings to the customer, so the customer is guaranteed to profit from the arrangement.

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