



# **A ROAD MAP FOR ENERGY EFFICIENCY & CONSERVATION IN PAKISTAN**

*A Position Paper prepared by OICCI Energy Subcommittee*

### Acknowledgements:

- a) Progas Pakistan Limited
- b) Pakistan Petroleum Limited
- c) Mr. Javed Akbar
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- e) Mr. Ubaid ur Rahman, Chevron Pakistan
- f) Mr. Sarfraz Nadir, International Power
- g) Mr. Abbas Bilgrami, Progas Pakistan Limited

### Resource Material:

- a) Exxon Mobil Outlook for Energy 2030
- b) BP Global Energy
- c) New Zealand Energy Strategy – Ministry of Environment
- d) Integrated Energy Plan, Department of Mines and Energy, South Africa
- e) Integrated Energy Plan 2009 – 2022, Ministry of Finance, Government of Pakistan
- f) Hard Truths, National Petroleum Council, USA
- g) Caribbean Youth Environment Network
- h) Possibilities for Energy Conservation 100 tips for Day to Day Life, M.U. Borekar, V.S. Sapkal, R.S. Sapkal

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### EXECUTIVE SUMMARY

#### Introduction

The Sub Committee on Energy under the auspices of the OICCI (the Chamber) has been empowered to produce a Position Paper on Energy Efficiency and Energy Conservation in Pakistan. Key drivers are to develop a document that is not only simple to understand but which is also accompanied by recommendations for effective governance and implementation on a country-wide scale. The document considers both the macro and micro level perspectives of energy usage in Pakistan and proposes a road map that provides the opportunity to make quick wins as well as lays down medium term and strategic goals which look at the regulatory framework, infrastructure, public outreach, fiscal policy and education.

The Managing Committee of the Chamber and all members are invited to debate and support the proposals outlined in this paper with a view to ultimately making recommendations to the Government of Pakistan.

#### The Situation

From 1980 till present day, the demand for energy in Pakistan has grown almost six-fold and it is estimated that it would again double by 2015. With an inordinately significant dependence on hydrocarbons as its primary energy source, the situation is not sustainable. The state of affairs is not helped by a growing population with a low median age, low per capita energy consumption yet high energy intensity and a recent boom in cheap but energy hungry home appliances. Contrary to this situation, energy demand in developed economies such as OECD (Organisation for Economic Cooperation and Development) member states is actually expected to be lower in 2030 versus 2005 levels, despite a more than 50% projected growth in their economies. This would only be possible due to significant advancements in energy efficiency in these countries and Pakistan would benefit from the study of their models.

For Pakistan, the continued dependency on bio mass and petroleum products could have disastrous consequences in the short to medium term. Assuming current global oil prices remain unchanged, Pakistan's import bill for its energy needs could easily exceed an unaffordable US\$ 40 billion in the next decade or so. The existing energy infrastructure is also in a desperate need of an upgrade: transmission and distribution is inefficient, major water reservoirs are losing capacity and the current pricing strategy provides numerous opportunities for arbitrage which create an expensive imbalance in the energy mix.

Pakistan also lags far behind its peer group in terms of relying on coal as a resource for its energy needs, despite having numerous proven coal reserves within its territories. Pakistan has a generally mild to warm climate, a large area and coastline as well as numerous sources of fresh water, all of which provide excellent opportunities for exploiting alternative and renewable energy sources. Unfortunately Pakistan has yet to take full advantage of these bounties of nature.

### **Efficiency Leads to Sustainability**

Pakistan like other developing countries is expected to double its demand for energy every 12 years. Non-OECD electricity demand is expected to be responsible for 80 percent of total growth in electricity demand through 2030. At that time, electric power generation would still account for the biggest share in primary energy demand with coal as the main fuel. In a world that is continuously becoming more energy efficient, Pakistan's relative inefficiency is evident through its high energy utilization per unit of Dollar GDP. Rapidly depleting natural resources and climate change awareness will result in tougher global legislation on how countries consume energy resources. Pakistan can reduce emissions by increasing efficiency in day to day operations, using new energy efficiency technologies and by reducing flaring and venting of hydrocarbons in the E&P sector. The Chamber can play a vital role in making new industrial technology accessible to the public to also enable the end consumer to reduce energy consumption. This is important because whilst about 10 percent of petroleum related greenhouse gas emissions are from industry operations, 90 percent are from consumer use of petroleum such as transportation, including air travel.

A small consolation is that currently energy consumption in Pakistan per capita remains very low, but in that also lies the potential for rapid growth which cannot be sustained if we do not have reliable, clean and economical sources of energy.

### **The Way Forward**

The key issues Pakistan is currently faced with regarding its energy needs are inefficient energy utilization, the indiscriminate use of subsidies, lack of public awareness, ineffective or unenforced legislation, poor governance and under developed infrastructure. In order to provide the necessary strategic and operational impetus, the government should consider making energy efficiency and energy conservation key themes in the Integrated Energy Plan 2010 – 2025 and the 10th Five Year Plan. This paper proposes the creation of a Ministry of Energy tasked with facilitating investment in energy efficiency measures and maintaining Pakistan's security of energy supply. The Ministry could assist in the development of a sound national energy conservation and energy efficiency policy infrastructure. This will include the regulatory framework, building codes and educational programmes.

The concept of using smart technology, coupled with smart consumer behaviour must be instilled into the nation by the government through education, sensible pricing and through incentivizing consumers. The Chamber should lead by example and demonstrate how it has used these principles to conserve energy. The multinational membership of the Chamber, many of whom are global corporations having extensive presence in all corners of Pakistan, is especially well placed to add a substantial push to such initiatives. It is therefore no surprise that by 2030 energy saved through improved efficiency is predicted to be so significant that it would become an important "fuel" in its own right. A developing nation like Pakistan would find it more cost effective to increase its energy supply through efficiency and conservation efforts as compared to building new generation capacity. There are other benefits to be had as well,

for example improved building insulation can make people healthier, reduce heating costs and reduction in energy related greenhouse gas emissions, and ease energy supply constraints in winter.

### **Conclusion**

A nation does not become energy inefficient overnight; it is a slow process that is influenced by a multitude of social, political, financial and economic considerations. While a large number of barriers have to be overcome in the drive towards energy efficiency, it is quite possible to make meaningful gains in a relatively short time. Provided that there is complete alliance between all stakeholders (which in this case includes everyone), it is estimated that by 2015 there could be energy savings of almost 20% in Pakistan's overall energy consumption.

This paper proposes that the Chamber, in collaboration with its members and business partners, develops an Energy Efficiency and Energy Conservation Programme that focuses on providing the people of Pakistan with real life, simple and tangible ways to save energy.

Naturally, the government would need to play a leading role in setting up accurate pricing policies, devise and enforce minimum energy performance standards, incentivise investment in energy efficiency measures and increase overall public education and awareness on the importance of energy efficiency and conservation. The National Energy Conservation Centre (Enercon) would develop partnerships with all power generation and transmission utilities, regulatory authorities and private power producers to ensure a coherent and consistent message is delivered. The Chamber would play an important role in helping fund and being a technology partner to Enercon by encouraging its members to run media campaigns supportive of and aligned with this initiative. In the longer term, the Chamber would assist the Government of Pakistan in developing a policy infrastructure that would allow Enercon to build a public-private partnership with all stakeholders (including the general public) to make energy efficiency and energy conservation a part of every Pakistani's conscience and consciousness.

### Purpose of Preparing this Discussion Paper

This document has been prepared at the request of the OICCI Energy Sub Committee.

### Terms of Reference

- Use examples of best global practices based on 'Implementing Power Rationing in a Sensible Way'
- Highlight the Scare Scenario - emphasizing the consequences if the energy conservation measures are not initiated in a timely fashion.
- Highlight basic standards/ principles and bench marks for energy conservation
- Provide mechanisms for calculating energy consumption
- Use test cases for monetary quantify comparison where possible.
- Provide recommendations or suggestions for mass awareness (like school awareness campaigns, training of faculty, printing pocket cards or pamphlets with summary of the tips to be distributed at public places, printing of energy conservation tips behind utility bills, etc). Corporate departments to sponsor this. Education boards and NGOs to be contacted to participate in such a programme.
- Consider proposing standards for monitoring energy consumption and penalty/reward scenarios, for example tax breaks for those who are energy efficient.

It was agreed that once finalized, energy conservation good practices would be shared with all OICCI member companies for inclusion in their awareness programs and would further be presented to the relevant government authorities in order to establish a mutual partnership for mass awareness.

Since the terms of reference given below were somewhat vague and unclear, after a lengthy debate between Mr. Monem, Mr. Fasih uz Zaman and Abbas Bilgrami, it was decided that this group would not prepare general Energy Saving Proposals for use by members of the OICCI. These proposals would really amount to nothing more than a collection of ideas on energy conservation and efficiency. Most companies who are members of the chamber already undertake energy efficiency and conservation plans for their respective industry. What is needed is a much more high level policy paper which could be promoted by the Chamber to the Government of Pakistan. These recommendations would allow the government to benefit from the experience of the members of the Chamber both locally and internationally. The team would give a road map for implementation by taking into confidence key stakeholders (education boards, NGOs etc) otherwise the study would merely gather dust.

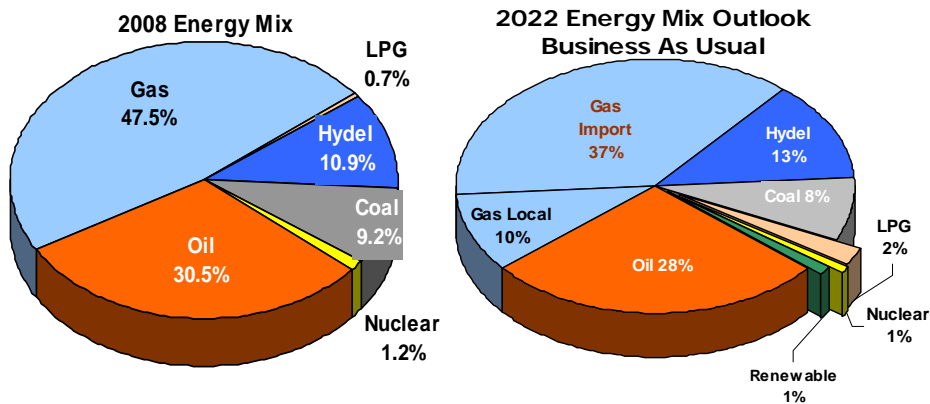
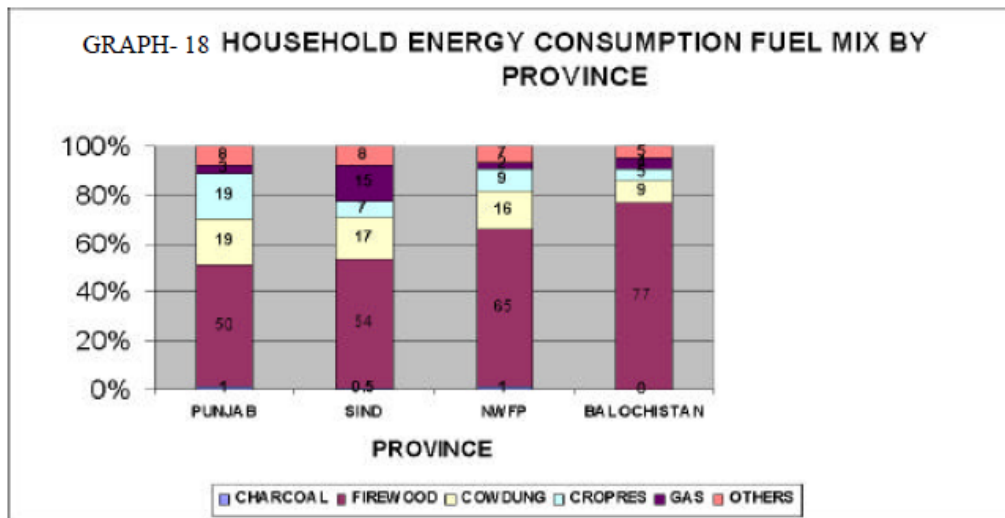
It is with this in mind that we have undertaken to prepare this 'Road Map for Energy Efficiency and Energy Conservation in Pakistan'.

We trust that the Chamber's Sub Committee will endorse this document after discussion and use this as a starting point for developing a dialogue initially with its own members and then with the Government of Pakistan.



**The Situation: Locally & Internationally**

Pakistan’s population and economic growth are expected to continue to drive energy demand ever higher. Current estimates undertaken by the Energy Expert Group under the auspices of the Economic Advisory Council, Ministry of Finance, shows that demand for energy will grow from the current 68 MMToe to well over 122 MMToe by 2015. When compared with total energy consumption in 1980 of close to 12 MMToe and around 33 MMToe in 2000 the growth in energy consumption is likely to continue. What is also evident is Pakistan’s inordinate dependency on petroleum products and on bio mass.



If Pakistan continues without altering its huge dependency on Bio Mass and Petroleum Products it will have no forest cover within the next seven years and will have an import bill of well over \$40 Billion by 2022 (assuming a constant but currently outdated price of US\$ 70/ BBL) for petroleum imports. We do not have the capacity to pay for this and will have to drastically alter our energy mix by practicing 'good governance' in energy sector as indicated in the recommendations of the Energy Expert Group. These include conservation, becoming more efficient and going for more renewable sources.

## A ROAD MAP FOR ENERGY EFFICIENCY AND CONSERVATION IN PAKISTAN

Industry experts expect that global energy demand will rise by an average annual rate of 1.2 percent per annum through 2030, when the world will be using almost 35 percent more energy than it did in 2005.

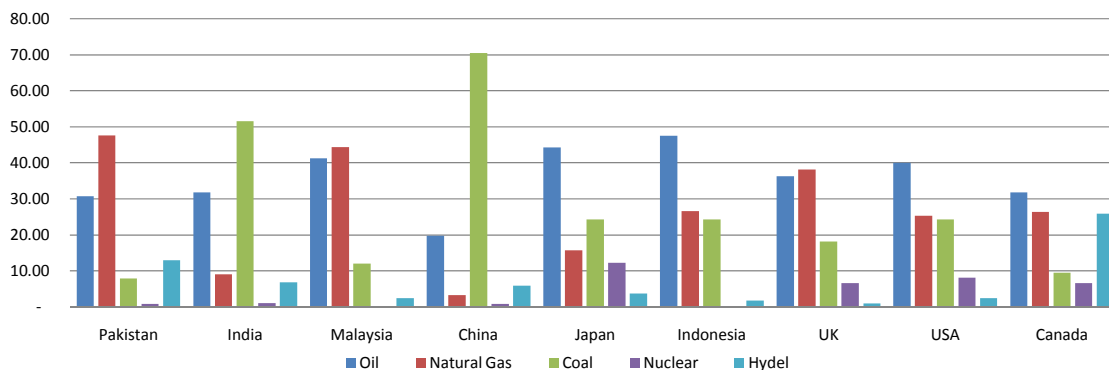
Pakistan's economic growth rate is expected to grow at 5% per annum according to industry experts (Integrated Energy Plan 2010-2025, EAC, Ministry of Finance); while during the same period energy growth will be at 6.25% per annum. Pakistan like other developing countries is expected to double its demand for energy every 12 years. This will put a huge burden on Pakistan's resources. Ironically, in OECD (Organization for Economic Co-operation and Development) countries energy demand will be essentially flat and CO<sub>2</sub> emissions will decline through 2030 even as its economies and populations grow. Energy efficiency and energy conservation will play a key role in achieving this goal.

By comparison to its peer group, coal does not play a significant role in filling part of its energy mix. Pakistan needs to build up its hydro electric resources not just for power generation but to also increase its water storage capacity as Mangla and Tarbela come to the end of their useful lives. The exhibit below for Primary Energy Mix 2010 clearly shows that Pakistan is behind its neighbours and developed nations in developing its coal resources for energy generation purposes.

### PRIMARY ENERGY MIX

|  | Pakistan | India | Malaysia | China | Japan | Indonesia | UK | USA | Canada |
|--|----------|-------|----------|-------|-------|-----------|----|-----|--------|
|--|----------|-------|----------|-------|-------|-----------|----|-----|--------|

|                    |       |       |       |       |       |       |       |       |       |
|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Oil</b>         | 30.76 | 31.78 | 41.19 | 19.75 | 44.24 | 47.47 | 36.22 | 39.94 | 31.80 |
| <b>Natural Gas</b> | 47.59 | 8.95  | 44.33 | 3.25  | 15.69 | 26.53 | 38.12 | 25.23 | 26.30 |
| <b>Coal</b>        | 7.90  | 51.43 | 12.04 | 70.37 | 24.22 | 24.26 | 18.16 | 24.29 | 9.45  |
| <b>Nuclear</b>     | 0.86  | 0.99  | -     | 0.76  | 12.20 | -     | 6.53  | 8.14  | 6.56  |
| <b>Hydel</b>       | 12.89 | 6.85  | 2.44  | 5.87  | 3.65  | 1.75  | 0.97  | 2.41  | 25.89 |



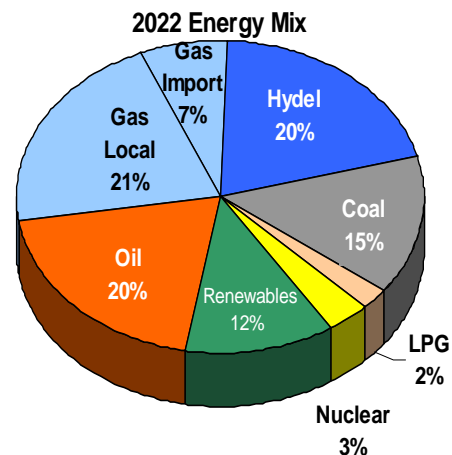
## A ROAD MAP FOR ENERGY EFFICIENCY AND CONSERVATION IN PAKISTAN

While global energy demand is expected to rise by almost 35 percent through 2030, to fully understand the energy outlook in coming decades, we need to examine what is going on in developed (OECD) countries (like the United States and European nations) and non-OECD nations (such as China and India), because the trends in these two groups can be starkly different.

Through 2030, the economies of non-OECD countries, while still relatively smaller, will grow at a much faster rate than those of the OECD nations. By 2030, these developing economies will have reached close to 60 percent of OECD economic output. Rapid economic growth is expected to produce a steep climb in energy demand. In fact, Exxon Mobil expects that between 2005 and 2030, non-OECD energy demand will grow by about 65 percent. However, even with this rapid growth, per-capita energy demand in non- OECD countries still will be much smaller than in OECD countries.

By contrast, in OECD countries, energy demand is expected to actually be slightly lower in 2030 versus 2005, even though their economies will be more than 50 percent larger on average. How is this possible? The main reason is efficiency. Industry experts continue to project substantial improvements in efficiency in OECD countries. In non-OECD countries, efficiency will improve, but faster growth in GDP and personal incomes will continue to drive demand higher.

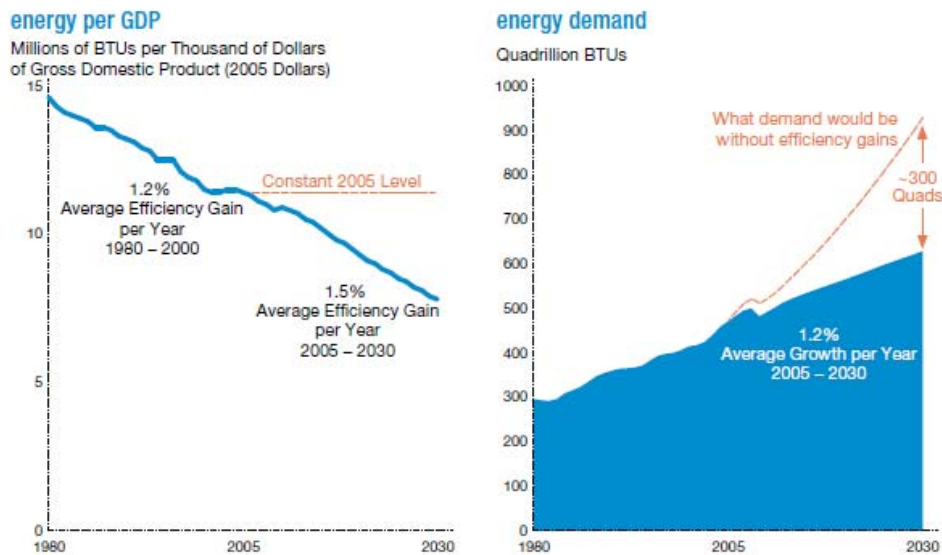
| <b>Energy Demand</b> |              |              | <i>M.Mtoe</i> |
|----------------------|--------------|--------------|---------------|
|                      | <b>1992</b>  | <b>2008</b>  | <b>2022</b>   |
| Oil                  | 11.53        | 19.18        | 24.49         |
| Gas Indigenous       | 11.68        | 29.88        | 25.72         |
| Gas Import           | -            | -            | 8.57          |
| Hydel                | 4.49         | 6.86         | 24.49         |
| Coal                 | 2.10         | 5.79         | 18.37         |
| LPG                  | 0.15         | 0.44         | 2.45          |
| Nuclear              | -            | 0.75         | 3.67          |
| Renewables           | -            | -            | 14.70         |
| <b>Total</b>         | <b>29.94</b> | <b>62.90</b> | <b>122.46</b> |



Pakistan should encourage energy efficiency and energy conservation which would result in significant reduction of primary energy demand. Additionally a serious thrust to change its energy mix lead to greater self reliance, energy security, a lower import bill, better power availability and targeted assistance to the poorest in society. At the same time pricing policies will allow for changes in customer behavior leading to reduced energy demand, improved energy efficiency and greater motivation for energy conservation. A strong measure of 'good governance' in the energy sector as indicated in the recommendations of the Energy Expert Group in the Integrated Energy Plan 2009-2022 must be undertaken. All of the above is necessary for Pakistan's economic survival and progress since it has to compete with the world for the supply of petroleum products which it imports to fulfill a significant proportion of its primary energy needs.

The world uses 15 billion BTUs of energy every second. As more countries move up the economic ladder, more energy will be required.

## Efficiency: Reducing Demand Growth



Our world continues to become more energy efficient. From 1980 to 2000, the energy it took to produce one unit of GDP fell by an average 1.2 percent a year. This occurred for a number of reasons, including the use of new, energy-saving technologies. We expect efficiency gains to accelerate between 2005 and 2030 versus historical trends, with energy-per-GDP falling at an average global rate of 1.5 percent a year. This faster pace will be driven by higher energy costs, government mandates and regulations, technology advances and expected CO2 emissions costs in OECD countries.

Improving efficiency at this rate will save a significant amount of energy.

Through 2030, ExxonMobil expects global energy demand to grow by an average 1.2 percent. To see how energy efficiency works to curb energy-demand growth, imagine if the world's economies grew as projected through 2030, but efficiency was held flat at 2005 levels. In that case, global energy demand in 2030 would not be almost 35 percent higher than in 2005, as we currently project; it would be about 95 percent higher. Put another way, gains in energy efficiency through 2030 will curb energy-demand growth through 2030 by about 65 percent. In this respect, the greatest source of energy in the future is finding ways to use energy more efficiently.

**Taking sensible steps to improve energy efficiency is a “triple win” – it saves money, reduces energy demand and curbs CO2 emissions.**

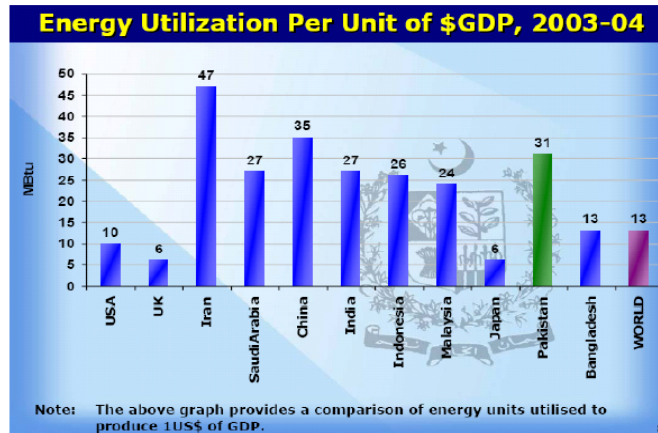
**Through 2030, the amount of energy saved through improved efficiency will be greater than the energy consumed from any single supply source.**

Gains in energy efficiency through 2030 will reduce global energy-demand growth by approximately

**65%**

Pakistan’s energy utilization per unit of US\$ GDP is an indicator of how inefficient we currently are at utilization of energy as a country. Though we have improved as energy converters over the past decade, pricing distortions (highly subsidized gas and electricity prices) have resulted in institutionalizing inefficiency and profligate usage of energy resources.

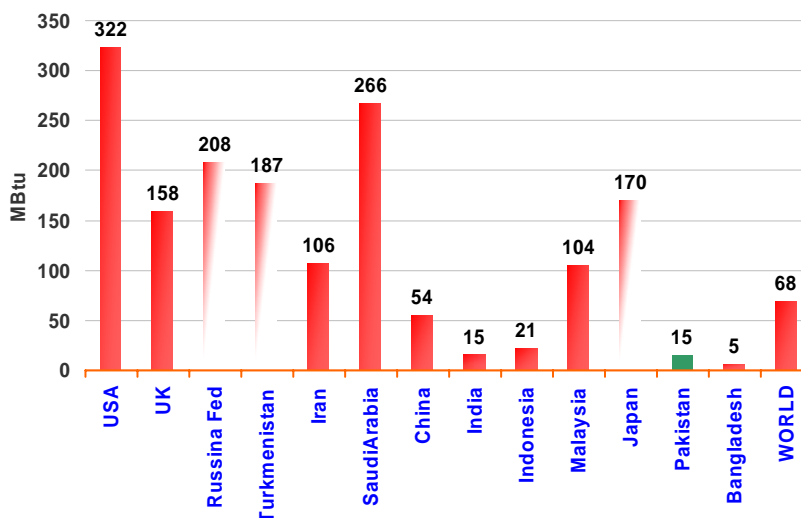
**FIGURE 6: THE ENERGY INTENSITY OF PAKISTAN’S ECONOMY RELATIVE TO OTHER COUNTRIES [GOP 2005].**



However despite these pricing distortions Pakistanis consume very little energy on a per capita basis. This anomaly further indicates that those who do have access to energy are inefficient converters. Inefficient conversion is a direct result of the pricing anomalies that exist in Pakistan’s policy structures.

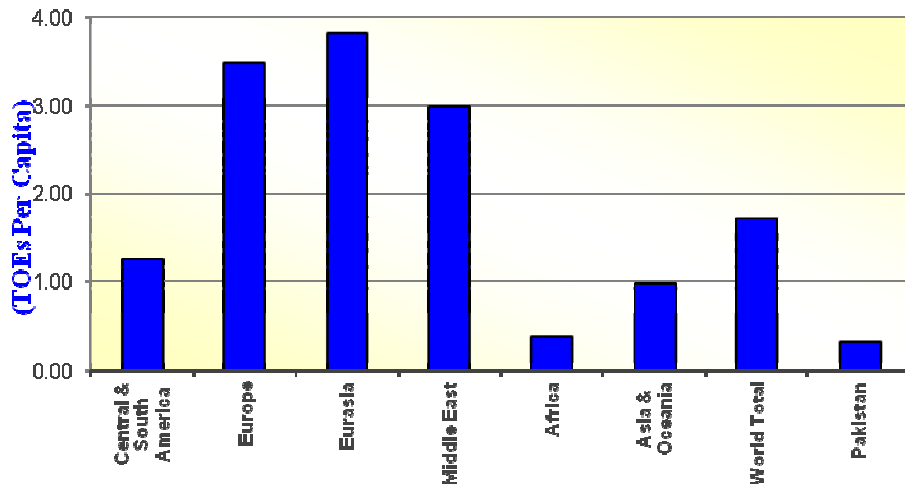
Figure-III

**ENERGY CONSUMPTION PER CAPITA, 2005-06**



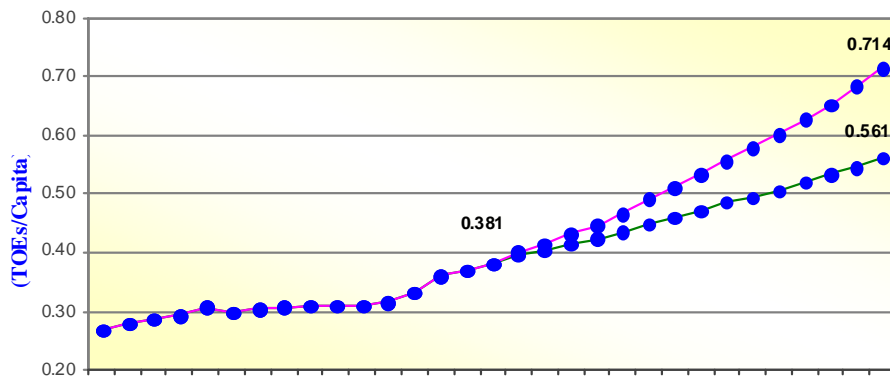
Source: BP Statistical Review of World Energy June 2007

**World/Regional Per Capita Energy Consumption Pattern 2007**



**Pakistan Energy Outlook 2008-2022**

**Pakistan: Per Capita Energy Consumption Trend**

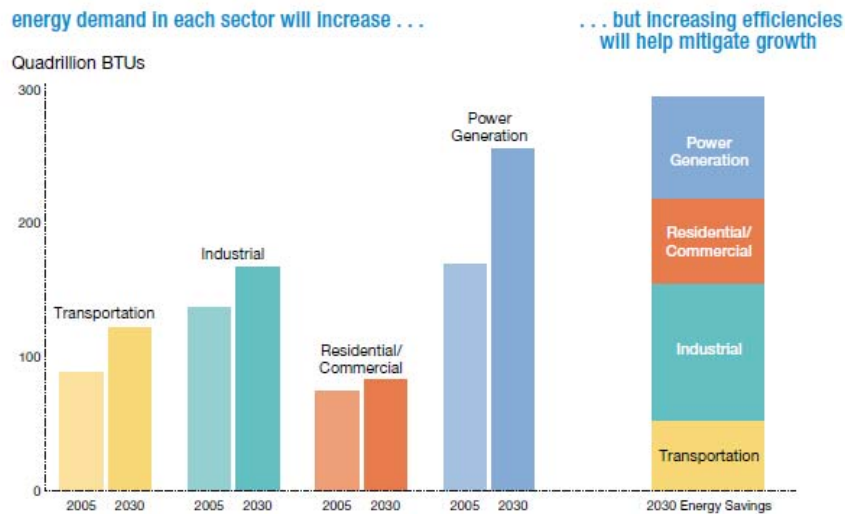


According to the Petroleum Institute of Pakistan, Pakistan’s expected energy growth between 2008 and 2022 will almost double energy consumption on a per capita basis from 381 Kg per capita to close to 700 Kg by 2022. If even a proportion could be saved through efficiency and conservation measures during this period it would reduce our dependency on imports and the consequent strain on our financial resources.

## Growing Global Demand

Broken down by the four main end-use sectors, the biggest demand for energy comes from electric power generation – a fact that might surprise some people, who may think that transportation is the largest. Transportation is, in fact, in third place behind industrial demand, which represents the energy used for manufacturing, steelmaking and other industrial purposes. Residential/commercial demand is the smallest sector.

Power generation is not only the largest energy-demand sector, but also the fastest-growing; through 2030, this sector represents 55 percent of the total growth in energy demand. The story behind the remarkable increase in demand for energy for power generation is not just the high-tech demands of the developed world, but also the more basic needs and economic growth of the developing world. Non-OECD electricity demand is expected to more than double by 2030 and will account for 80 percent of total growth in electricity demand through 2030.



Anyone asking how the world will meet its energy and environmental goals must consider electric power generation; by 2030, this sector alone will account for about 40 percent of total primary energy demand, and its largest energy source will continue to be coal, the fuel with the highest carbon intensity.

In each sector, demand will grow much faster without improvements in efficiency. Efficiency improvements in each sector will add up to significant energy savings each year – reaching 300 quadrillion BTUs in 2030.

By 2030,  
power generation  
will account for  
**40%**  
of all energy  
demand.

### Residential / Commercial Demand

In the residential/commercial sector – the energy we use in our homes and businesses – residential demand is around five times bigger than commercial demand. Pakistan’s domestic sector consumed 8.1 MMToe energy at in 2008 – 2009 compared to commercial consumption of just under 1.5 MMToe. Industrial consumption was just under 15 MMToe during the same period with the transport sector making up a further 11.4 MMToe. Additionally Pakistan consumed 15.3 MMToe of fossil fuels (including coal and petroleum products) in the thermal power generation sector and nearly 4 MMToe in non energy uses and in the fertilizer sector. Looking into the future Pakistan’s growth in energy needs will further exacerbate the mismatch in the inordinate consumption of energy in an inefficient manner due to pricing anomalies (subsidies) which in turn have lead to large increases in consumption of natural gas and electricity. The beneficiaries of such subsidies are generally not the originally intended recipients, and end up causing losses to the public exchequer.

Worldwide this trend is seen to continue as demand in this sector grows through to 2030. Residential energy demand is tied closely to the total number of households in the world. Through 2030, we see the number of households rising by 900 million, with nearly 90 percent of that growth occurring in non-OECD countries. OECD countries today use substantially more energy per household than non-OECD countries. While that remains true in 2030, all around the world, households are growing more efficient in their use of energy. Through 2030, the steepest decline in energy- per household will come from OECD countries, with more modest rates of improvement in non-OECD nations.

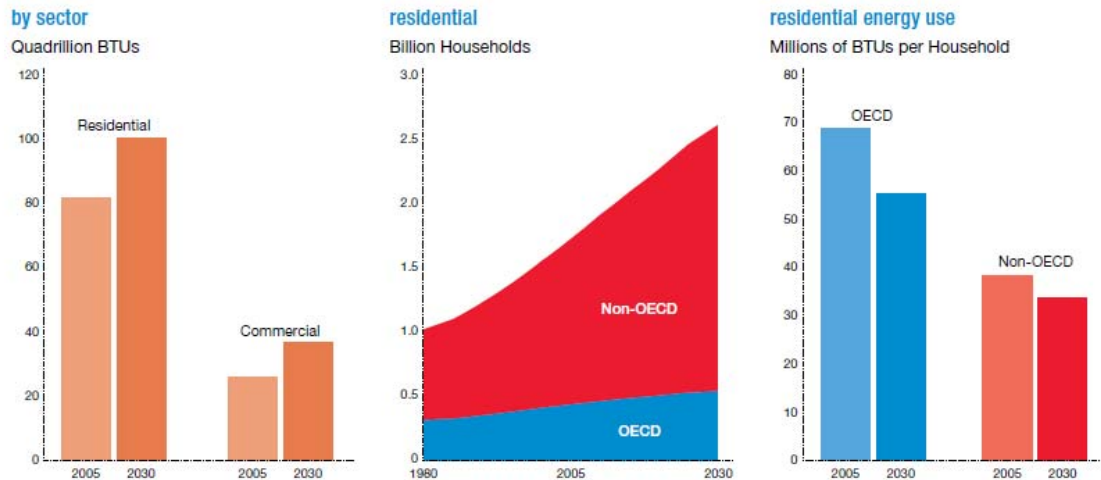
A diverse mix of energy is generally used to meet residential/commercial demand. Natural gas and electricity account for most of the growth in this sector through 2030. But biomass – fuels like wood and dung – will retain a substantial share of supply, mainly in the non-OECD.

(Note: In each sector, we have included “electricity” in the breakdown of demand by fuel. Electricity, of course, is not a fuel in itself – it must be generated by other energy sources such as coal and natural gas. But it is important to recognize the share of total electricity that is consumed by each end-use sector.)

There will be 900 million more households in the world by 2030 – and they will need energy for heating, cooking and appliances.



## A ROAD MAP FOR ENERGY EFFICIENCY AND CONSERVATION IN PAKISTAN



Pakistan can reduce emissions by increasing efficiency in day to day operations, using new energy efficiency technologies by reducing flaring and venting of hydrocarbons.

- Efficiency. It is our view that efficiency improvements can save 15 percent to 20 percent of energy consumption of the Pakistani textile sector, refineries, power and chemical plants. Investment in economic heat capture, upgradation of power generation facilities, and improvement of power and gas distribution systems will result in immediate savings.
- Cogeneration. OICCI members can expand the use of cogeneration – a process in which electricity can be produced to power their operations while also capturing heat to make steam needed to transform raw materials into consumer products.
- Flare Reduction. Across Pakistan, E&P companies (many are members of the OICCI) can reduce flaring of gas that has no economic outlet as well as gas that is flared as a result of maintenance, extended well testing or unexpected operating events.

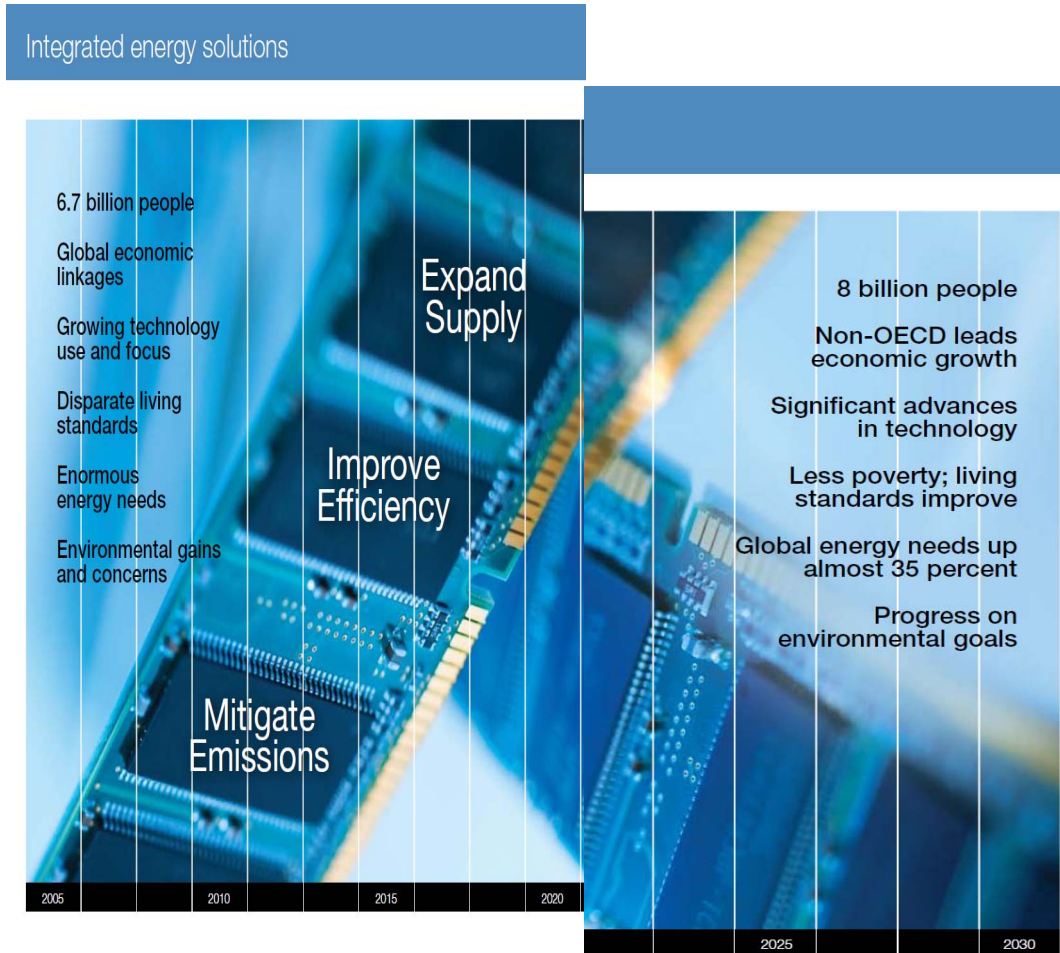
In addition to improving efficiency and reducing emissions in industry it is critical that the OICCI help commercialize the same technologies to help consumers reduce energy consumption. This is important because while about 10 percent of petroleum related greenhouse gas emissions are from industry operations, 90 percent are from consumer use of petroleum. Exxon Mobile believe that “Total global energy demand through 2030 is expected to rise by about 160 quadrillion BTUs. All of this growth will occur in non- OECD countries; OECD demand is expected to be slightly lower in 2030 versus 2005.

Through 2030, one of the most important “fuels” of all will be energy saved through improved efficiency. Energy saved through efficiency gains will reach about 300 quadrillion BTUs per year by 2030, which is about twice the growth in global energy demand through 2030. Most of the energy saved through efficiency will however be in OECD countries. It should be our aim to provide a significant amount of energy through energy saving and efficiency programmes from the 122 Million MTOE which will be needed by 2022.

OICCI motto

*Improve efficiency; expand energy supplies; mitigate emissions; develop new technologies*

**Each of these solutions will be needed to meet the interlocking energy challenges through 2030 and beyond."**



### The Importance of Energy Efficiency and Energy Conservation

Oil prices have tripled in the past decade and climate change has accelerated. How Pakistan deals with these two defining issues of our time will have a significant impact on our economy, environment and way of life.

- Energy efficiency uses smarter technology to deliver the same outcomes.
- Energy conservation uses smarter behavior to meet our needs and save us money.

Energy efficiency and energy conservation are the fastest, cheapest and most environmentally friendly ways to respond to the challenges of peak oil and climate change. It is now clear that renewable energy, at least for electricity, will be cheaper for at least the next 20 years than fossil fuels. The final energy efficiency and conservation strategy should be targeted, with a view to improving data and fixing the responsibility for delivering it.

Better insulated homes are cheaper to heat and healthier to live in. Businesses that embrace energy efficiency and engage their workers in cutting energy costs are more competitive. For example, farmers that use modern heat recovery systems and advanced vacuum systems in the dairy shed are more profitable, and vineyards and tourism operators that can demonstrate their commitment to environmental sustainability gain an edge in overseas markets. The transport sector in Pakistan is in dire need of a clean-up. Pakistan continues to be a dumping ground for fuel guzzling and polluting vehicles, with Pakistanis spending much more per capita on transportation while suffering the effects of pollution, which causes hundreds of deaths each year.

The Government of Pakistan must act fast by setting challenging targets, some of which are noted below:

- Introduce fuel efficient vehicles;
- Focus on using cleaner alternative fuels e.g. LPG in order to reduce our dependency on CNG;
- Encourage the use of biofuels and new technologies;
- Introduce efficiency incentives that reduce the number of one-person car trips,
- Improve public transport, develop safer pedestrian walking and cycling zones ; and
- Develop Mass Transit programmes in major cities.

The Government needs to take the lead by reducing its own energy use during travel, in office buildings and in its purchasing policy. Local Government should set an example with its own energy use, and the way it plans for its communities. The Chamber could show through its own actions where and how it has saved energy through energy efficiency and conservation measures.

## The Pakistan Energy Efficiency and Conservation Strategy

The government's policies, objectives, targets and means for energy efficiency, energy conservation should be a subset of the Integrated Energy Plan 2010-2025 and 10th Five Year Plan.

The government should set out its actions to promote more efficient use of energy. It should focus on implementation by sector, identifying the main measures, policy instruments and assigning responsibility for actions to be taken. In the stationary energy efficiency area, there are two main priorities that should guide the actions of the proposed Ministry of Energy.

- The first priority is maintaining security of energy supply. For electricity, this is essential for both dry-year energy and peak demand. Energy efficiency can improve energy security by reducing demand and reducing peak load.
- The second priority is to facilitate investment in energy efficiency measures that are cheaper in the long run than the costs of building extra generation and network capacity, including environmental impacts such as the cost of greenhouse gas emissions.

Pakistan needs an energy system that is reliable, resilient, and fairly and efficiently priced in the future. Energy efficiency will be an important part of achieving this goal. Energy efficiency measures can:

- Reduce energy costs, including the need to build more costly electricity generation capacity
- Reduce greenhouse gas emissions and other local effects from the production and use of energy
- Enhance security of supply by increasing the margin between supply of energy and demand, particularly at peak times
- Enable economic and environmental resources to be used more efficiently
- Provide other benefits to people and to communities, such as creating warmer homes that lead to better health
- Increase public awareness of energy issues and of the everyday energy efficiency measures that can contribute to our sustainable energy goals.

Much of what we consume, from paper to processed food, requires significant amounts of energy to produce. The cost and environmental impact of this lifestyle is increasing, and unchecked demand growth affects our energy security.

The price of energy is likely to continue to rise as more expensive supply options are developed. Energy is generally produced remotely, so we tend not to notice the impact of our energy use. Morgan Stanley expects prices for crude to be back at US\$ 140 per BBL by 2013. This makes it

all the more important for the OICCI members to take heed and start introducing energy efficiency and conservation measures that will ultimately reduce the amount of energy they require and thereby improve their profitability.

Energy efficiency can be defined as the ratio of productive output to energy use. Improving our use of energy is about cost-effectively reducing the amount of energy required to create a given quantity of a product or service (such as a litre of milk, or a warm room). Pakistan is not particularly efficient in the way it uses energy, and there are many opportunities to make improvements. This is evident from Figure 6 on page 13 in which Pakistan's energy intensity in 2003/ 4 was shown in the quantum of energy needed to generate a US\$1 of GDP. Saving energy makes common sense in areas where the savings are cheaper in the long term than the financial and environmental costs of generating more energy.

### The Progress We Can Make

Existing measures to encourage Pakistanis to use energy more efficiently in the stationary energy sector (i.e. excluding the transport sector) have centered on products, homes, buildings and industry: Efficiency home grants to help with insulation, efficient wiring and energy efficient appliances in low income households. The project will have major health benefits for families involved, particularly for people with asthma or other respiratory illnesses.

- Solar water heating finance assistance programmes should be put in place by gas utility companies to encourage people to use solar water heating and thereby strengthen local industry.
- PEPCO's electricity efficiency initiatives should include a compact fluorescent lamps (CFL) campaign and a complete change over from incandescent lamps. However procedures for handling CFL's when they are fused must also be put out in order to ensure that mercury pollution from the CFL's is contained.
- Building codes must be reviewed to target significant energy efficiency improvements in houses and buildings.
- The Ministry of Energy should be empowered to enforce minimum energy performance standards and labeling programme covering appliances and various types of machinery. Endorsement labeling should be introduced for highly efficient products.
- Enercon programmes should provide energy audit grants and support to the country's 500 largest industrial energy consumers to introduce energy efficiency initiatives. These savings should be then made public.
- Enercon should carry out an economic assessment of barriers to using electricity-efficient technologies in commercial buildings.
- The government should take up leadership in implementing such energy efficiency measures in buildings, transport and appliances throughout Government departments and public sector organizations.

### Our Actions

Barriers that slow down the rate at which we can improve our energy efficiency include the following:

- Lack of reliable information on costs and benefits, including energy prices that do not fully reflect all costs
- Energy price signals are often weak and do not sufficiently encourage some households and businesses to take cost-effective measures, especially at times of peak demand
- Absence of appropriate incentives (for example, for architects, builders and landlords)
- Low priority of energy efficiency for consumers, which is partly because of relatively low historic energy prices
- Competition for time and attention to implement opportunities
- Access to capital for energy efficiency investments

These barriers are largest for smaller consumers, especially households, and smallest for major energy-intensive industries. The government should support households and businesses voluntarily investing in energy efficiency improvements, but should have a more active role to play when there are barriers that prevent cost-effective energy efficiency investments being made, for example, it should help fund the retrofitting of older houses occupied by low income families, conversion of inefficient gas heaters to efficient gas heaters or solar water heaters, assist in central heating and cooling systems for large installations. Rapid progress depends on government policies, market forces and public acceptance to:

- Change behaviour around capital and technology investment decisions and consumer lifestyles and choices
- Deploy technologies particularly suited to Pakistani conditions
- Ensure energy efficiency is considered in the upgrade, design and management of processes, buildings and infrastructure

Interventions will be guided by the principles and framework set out in this strategy and in the National Energy Conservation Programme and will be subject to detailed analysis of their costs and benefits. Enercon should be tasked to prepare an Electricity Efficiency Potentials study. Identify the cost-effective electricity efficiency potential of the Pakistan economy, and the Ministry of Energy's role in realizing this potential. The information produced by the potentials study will underpin the Ministry of Energy's future electricity efficiency activities.

The Ministry of Energy's 'Potentials Study' should be a national priority, and the results from this study would provide strategic direction for the Energy Efficiency and Energy Conservation policy structures and should be reviewed on a regular basis. The economic potential for electricity savings in the view of the Energy Expert Group is up to 15 per cent of base electricity use by 2015 out of which one third savings are achievable through electricity efficiency

programmes that could be implemented by Enercon under the auspices of the proposed Ministry of Energy.

The Energy Expert Group believes that long-term savings could be much higher, with increased uptake and developments in technologies. Enercon under the guidance of the Ministry of Energy should produce an analysis of potential energy efficiency gains, which reflect a wider range of benefits. The value of co-benefits, such as reduced greenhouse gas emissions and outcomes for householders such as health benefits from warmer houses and cleaner air, are important inputs into assessment of the net benefits of government interventions.



### Promoting Energy Efficiency

Government leadership and action from firms and individuals would be needed to substantially improve energy efficiency. People will be more able to make cost-effective choices if they are given the right information when they buy a product. Incentives to encourage people to minimize costs over the lifecycle of their assets, rather than just the initial costs, will also improve energy efficiency.

One of the easiest solutions to reducing the burden on Pakistan's economy would be the development of a sound National Energy Conservation and Energy Efficiency Policy infrastructure. This would include the regulatory framework, building codes and educational, demand and supply management programmes.

#### Government Leadership

The government would need to encourage the public to take energy efficiency and conservation measures and use renewable sources of energy. A programme for core central agencies, departments and ministries, focusing on four key areas:

- Recycling/waste minimization
- Buildings
- Transport
- Office consumables and equipment.

There are also two major cross-cutting themes – sustainable procurement (also known as sustainable purchasing – not to be confused with security of supply) and energy efficiency.

#### Pricing Mechanisms

Accurate prices are necessary to signal the actual costs of energy supply. The present pricing strategy of fuels does not consider the cost of greenhouse gas emissions; however the energy efficiency initiatives set out in the Integrated Energy Plan can help reduce the impact on power bills.

At present, smaller electricity consumers and householders do not have smart metering technology and tariffs to enable time-of-use electricity pricing. PEPCO is working on setting out guidelines for the introduction of smart meters. The government through the proposed Ministry of Energy will need to provide estimates of future prices to help firms and individuals make decisions on investing in energy-intensive plant and equipment.

### **Information and Labeling**

Existing appliance labeling and a *Home Energy Rating Scheme* should not just emphasize energy efficiency but be locked into future imports and local manufacture of appliances. These initiatives will help people make better energy choices and provide a basis for the possible introduction of minimum performance standards and incentives.

For new buildings and other long-lived assets where energy use is locked in for decades, it is important that high-quality information and analysis supports design decisions. The ongoing review of the Building Code and the use of best practice standards will improve design decisions at low transaction costs.

Equipment suppliers and the energy industry can help consumers make even better choices in future, provided they have clear drivers to do so. The government also helps consumers make cost-effective investments by providing independent information and maintaining programmes that demonstrate the value of new technologies and energy efficient assets.

Government support for information and monitoring initiatives is justified where initiatives also offer significant health and social benefits, such as the recent SNGPL programme to promote the use of specially designed water heaters and the promotion of 'Energy Saver' CFLs.

### **Incentives**

The government should provide direct financial incentives for investment in energy efficiency measures that offer substantial net public benefits and would not be viable without government support. The gas and petroleum development levies, for example, can support investment to achieve savings in hydrocarbon and electricity consumption and these savings would be a cheaper source of energy supply as compared with the costs of a new supply. The government is particularly active in improving residential energy efficiency by providing grants and interest-free loans for insulation, clean heating and solar hot water.

For businesses, grant and subsidy programmes to upgrade industrial equipment need to be expanded. In the rural sector bio-energy and distributed hybrid power generation should be promoted through the auspices of the Ministry of Energy.

### **Standards**

Where there are weak incentives for the market to deliver solutions with net public benefits, the government has a role in setting minimum standards. There are already minimum energy performance standards at point of sale for some appliances and for building construction.

The government should empower Enercon to implement energy efficiency and conservation by updating the National Energy Conservation Policy 2005 which should also include several new product classes and make compliance levels for existing product classes more stringent.

### **Institutional Issues**

Government agencies that support improved energy efficiency in the stationary demand sector should include the Ministry of Water and Power (PEPCO), the Ministry of Energy, the Ministry for the Environment (ENERCON), the Ministry of Petroleum and Natural Resources (SSGC, SNGPL). The common objective of the National Energy Conservation and Efficiency Policy would be to promote the use of electricity in an efficient and environmentally sustainable manner.

The Enercon's main role should be to deliver energy efficiency programmes and provide advice to the Government on how energy could be used more efficiently.

The Ministry of Energy's main role would be to act as an implementer of policy programmes and initiatives to ensure that energy is produced, delivered and used in an efficient, fair, reliable and environmentally sustainable manner. It is important that the NEA develop a memorandum of understanding setting out the way it will work and manage areas that overlap between itself and the various Ministries and Regulators.

Private firms must be applauded and efforts showcased for investing in measures to help consumers become more energy efficient. However, there is scope for even more effort, particularly from energy companies and retailers, through leveraging of existing commercial relationships and through government partnering with third parties. The government has allocated a substantial amount of additional funding to deliver a wider range of residential energy efficiency through third parties.

Local government will need to play an important role in implementing programmes and policies, including the administration of Building Codes and making decisions on urban form and transport planning. Pakistan can achieve significant energy savings through simple conservation and efficiency programmes. The cost of such programmes would be much lower than setting up new power plants.

### Conclusion

Energy efficiency offers a vast low cost energy resource for the Pakistan economy, but only if it can be unlocked successfully. Significant and multiple barriers will need to be overcome to achieve the massive energy savings that are possible in millions of households, hundreds of thousands of business establishments, thousands of factories and scores of public and private organizations. These savings which account for nearly 20% of total energy consumption are the equivalent of 15 million TOE. This is greater than all of Pakistan's energy imports and something achievable by 2015. However this will require the nation as a whole to create efficiencies where possible and conserve energy where it is necessary. In this the Government of Pakistan must play the leading role but each citizen of this country will need to actively participate. Through this document the OICCI can initiate a debate which can be cascaded to the Government and also shared with the general public.

As a first step the OICCI should study the example of the South African National Energy Efficiency Agency. This agency was set up with the support of private and public companies that have undertaken to launch an energy efficiency and conservation initiative on a nationwide basis. A similar partnership between Enercon and the corporate sector with OICCI members taking the lead could result in a significant enhancement in efficiency and conservation initiatives.

A second measure would be to debate and finalise this discussion paper within the OICCI so there is a clear buy in from all members.

The Third measure would be to assist the government and the Enercon which should have a direct representation from the private and public sector to ensure proper implementation of this initiative by seeding the funding of this programme through the OICCI. However the bulk of the funding can be raised very easily by the government in conjunction with international donor agencies and specialist institutions.

## APPENDIX 1

### Energy Conservation Methods - General Guidelines

Electrical Consuming Devices by category (End-User):

Interior Lighting: [lamp/luminaries, bulb, fluorescent (standard/compact)]

Good energy management can easily cut lighting energy usage in half. The reductions in waste heat also decrease the need for air conditioning.

- Consider the purchase of compact fluorescent lamps/luminaries (CFL). These lamps produce less heat and last longer. Fluorescent lamps are three (3) times more efficient and last ten (10) times longer.
- Rooms can be light-zoned. In non-reading and non-working areas reduced lighting (25 watts – 40) watts can be used.
- Avoid “long-life” bulbs. They are 20% less efficient than the standard bulbs.
- Dimmer switches can save energy when used with incandescent lighting fixtures.
- Use high-pressure sodium or metal halide lamps for outdoor/external lighting (i.e. which are left on all night).
- Turn off all lights, when someone is not occupying the washroom, closets and infrequently used areas.
- Report any and all electrical lighting problems/faults or malfunction to the Public Works Department and the Electrical Inspectorate Division – Public Works or your maintenance/repair personnel.

Office Equipment: [printer, scanner, photocopier, facsimile/fax, calculator, cash machine, paper shredder, detacher, transformer (power):

- All office equipment must used be in accordance with the suppliers/manufacture operational procedure manual; failure to comply can and would result in poor equipment operation and failure.
- Use as necessary or as the need arises. All nuisance use or non- work related task and assignments are to be avoided.
- Do not leave transformers plugged into the wall outlet receptacle; disconnect (turn-off the outlet switch) and isolate (remove) all transformers at the end of the working day.
- Shut off unnecessary computers, printers, and copiers that are not in use and close-down/disconnect at the end of the working day.

### Computer & Electronic (Operational) Equipment: [personal computers, electronic (processing) equipment]

- For efficient use it is recommended that all personal computers (PCs) utilize the power management option. PATH - go to the computer **Desk Top**, click on **Start-Settings-Control Panel-Power management Option**: The time settings in this power option controls how long the PC takes to enter the standby mode to conserve energy if left unattended.

#### Suggested Settings:

1. Monitor – 15 min.
2. Hard Disk – 25 min.
3. System Standby – 30 min.
4. Screen Saver – 1 min.
5. Additionally, use the automatic save feature when working in all applications, preferably at one (1) minute intervals.

For power saving tips, refer to the section on office equipment above.

### Air Conditioners

- All office windows are to be covered by light coloured blinds/curtains or screens. E.g. white, beige, light cream, to reduce heat conduction, radiation and convection. Awnings to shade windows also help.
- Unit setting should be at 22 – 24 deg. C. Each degree increase will reduce air conditioning consumption by approximately 8 %.
- All doors, windows and openings are to be thermally sealed and kept closed on entry/exit to reduce unit overwork.
- Seal leaky HVAC ductwork – with the duct system fan operating, periodically check duct air distribution system for air leaks.
- Depending on occupancy level and local area disposition, room air conditioners (window type units) can be replaced by more energy efficient split units or central air conditioners.
- Set thermostat/temperature control to “auto”. The “fan-on” setting will increase energy use.
- Do not use ceiling fans with the air conditioner unless the thermostat for the air conditioner is set higher than normal e.g. 26 – 28 deg. C.
- Seal all leaks around coils.
- Provide shade for the condenser unit, without obstructing airflow currents.
- Review the maintenance programme for the air-conditioners, as poor maintenance contributes to low performance and energy losses.
- Fans should not run in rooms that are unoccupied.
- Ceiling fans can augment natural breezes to increase comfort. They can improve ventilation and lessen the need for air conditioning.

### Domestic Refrigeration, Heating & Ventilation: (refrigerator, freezer, chillers, water fountains, water heater, fans, ventilator)

- Be conscientious and mindful of the time spent with the refrigerator door open, during the entry and/or retrieval of items.
- Use as the need arises; however before opening (the door) think and decide on what item, one wishes to remove from the appliance.
- Set the level on the temperature control (thermostat) at 3 or 4 depending on the quantity of the items in the refrigerator (medium level or full).
- Allow warm food to cool before storing in the refrigerator.
- Make sure that air spaces under/beneath and behind the refrigerator allows for the free escape of hot air currents
- Motor and condenser coils should be kept free of dust.
- Proper (i.e. at appropriate times) defrosting as directed (by the manufacturer) increases efficiency.
- A second refrigerator or freezer only partly/partially in use should be turned off, so as to maximize the use of the other unit (refrigerator or freezer).
- Place refrigerator and/or freezer away from direct exposure to heat sources such sunlight and stoves.

### External Lighting: See section on Interior Lighting (above)

### Cooking, Domestic Equipment, Laundry & Clothes Drying: (oven, range/cooker, hot plate, microwave, toaster, blender/mixer, kettle, floor polisher, vacuum cleaner, dryer/blower, iron, television, video, radio/stereo, washing machine)

- All appliances must be turned off, when not in use.
- Microwave should be set at 'medium or medium-high' for 2 – 4 min. duration.
- Kettles should be quarter filled for preparing a cup of coffee, tea or chocolate.
- Stove/oven/ ranges are to be set on the medium range at 2 – 3 temperature level.

Laundry: Good practices saves on energy use for water heating, washing and drying.

- Use cold water for most clothes and for rinsing. This does not affect the quality of the wash.
- Use hot water (130F) only for colour fast cotton and stains.
- Use short wash cycle for lightly soiled garments.
- Wash full loads ALWAYS if and when possible.

Clothes Drying:

- Use a clothes-line or "solar clothes dryer". This saves 100 % use in electric energy.
- If a power dryer is used, wash and dry several loads in succession, since a warm dryer uses less energy.

- Dry ONLY full loads as often as possible.

### Miscellaneous Equipment: (motors, pumps, compressors, irrigation schemes)

- Stagger start-up times for equipment with large starting currents to minimise load peaking.
- If possible, shut off a piece of equipment before starting the alternate piece.
- Disconnect primary power to transformers that do not serve any active loads (e.g. periodic/seasonal loads or surpluses transformers).

### **NOTE:**

Only – absolutely essential power systems that are required to be in continuous operation should remain on.

The consumption for each metered entity, should be monitored, checked and control by the members of that entity as they are the guardians of the ‘electricity services’, the onus is therefore on the individuals (consumers) to ensure efficient utilization of the electricity. This concept must form a key component of any initiative on energy conservation.



## **APPENDIX 2**

### **An Example of a Successful Energy Efficiency Agency: The National Energy Efficiency Agency of South Africa**



The National Energy Efficiency Agency (NEEA) was officially established in South Africa in March 2006 through a directive issued by the Minister of Minerals and Energy. It has the following key objectives and key focus:

- The prioritization and recommendation of energy efficiency and Demand Side Management (DSM) projects to be undertaken in the country.
- Identification and development of key strategies, to address the growing demand for energy in the country, including gas, electricity, liquid petroleum, etc.
- Stimulate areas neglected in terms of energy efficiency in the past, such as the transport sector.
- Develop and implement comprehensive annual 'Energy Efficiency and DSM' awareness campaigns, to assist the general public in making wise choices when purchasing energy-consuming equipment and appliances.
- Oversee the integration and co-ordination of training in energy efficiency currently undertaken by various stakeholders in the country. The Agency will also facilitate skills transfer, capacity building and the creation of additional jobs in the field of energy conservation.
- Oversee the Measurement and Verification (M & V) of all energy efficiency and DSM projects undertaken by registered Energy Service Companies, (ESCOs), through Eskom.
- Co-operate with persons, associations and institutions undertaking energy efficiency programmes in other countries, to ensure that international 'best practices' are adopted and applied in South Africa.

Further information is available at the following website: [www.cef.org.za](http://www.cef.org.za).

## APPENDIX 3

### One Watt Initiative: a Global Effort to Reduce Leaking Electricity

By Alan MEIER\* & Benoît LEBOT\*\*

“Many domestic appliances and commercial equipment consume some electric power when they are switched off or not performing their primary purpose. The typical loss per appliance is low (from 1 to 25 W) but, when multiplied by the billions of appliances in houses and in commercial buildings, standby losses represent a significant fraction of total electricity use. Several initiatives to reduce standby losses have appeared in different parts of the world. One proposal, the 1-watt plan, seeks to harmonize these initiatives by establishing a single target for all appliances.”

Further details are available at [www.iea.org](http://www.iea.org).

\* Lawrence Berkeley National Laboratory, USA

\*\* International Energy Agency, France