# *Energy Efficiency Application in Yanbu Industrial City*

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**Abstract**
The Industrial City of Yanbu was established by Royal Commission of Yanbu (RCY) on the Red Sea to develop major energy intensive industries on petrochemicals. Oils from Eastern province are sent to the industrial city to save time and fuel during oil export. Saving time & energy is one of the commitment of today's modern city of Yanbu and be a model amongst the industrial city for energy efficiency. The city is dedicated to attract energy saving industries, support efficient use of land community zoning, develop carbon footprint calculation system, promote green technologies, encourage energy efficient industrial land use, and support industries that promote technology that are fuel efficient. The existing infrastructure, housing & building facilities in the city is energy efficient and likewise advocate the use of renewable solar energy. Funding is provided for renewable wind energy project. The overall energy design concept is the blueprint of RCY to achieve an energy efficient industrial city.

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## 1. Introduction

The Industrial city of Yanbu near the coast of the Red Sea was conceived in 1975. One of its mission was to develop and promote investment in petrochemical market aside from oil export. Oil from eastern province of Saudi Arabia are sent thru pipe to the industrial city to save time and fuel energy in transporting oil for export to Europe via the Suez Canal. Saudi Arabia is exporting millions of barrel of oil in response to the world growing energy demand. The global energy needs likewise is projected to increase enormously thus as the world economy expand, it needs more power energy. Since the source of energy is from fossil fuel or nonrenewable, there is a growing concern about energy efficiency, pollution, greenhouse effect and climate change within the kingdom. Recently, it launch the Saudi Arabia‘s Energy Efficiency Center (SEEC) with the goal of reducing power energy thru audits, load management, regulation and education and re channel the domestic fuel consumption for export to generate more revenue. One of the leading government entities is the RCY Industrial City. It has been committed in implementing energy efficiency thru regulation, infrastructure, land use and education thru environmental awareness program.

## 2. Policy

The government of Saudi Arabia spends billions of dollars in subsidizing the power energy need of the country. Studies have shown that 20% of the budget goes to domestic consumption. In addition, housing and private transportation are the two main cause of energy waste [1]. Houses are not properly insulated while there are so many private cars in the country since public transportation is not well develop. In other countries who experience oil price shock in early 70’s have develop a comprehensive policy and regulation to encourage energy efficiency thru tax credit, & incentives [12] while others develop and promote technologies that can make some household more energy efficient [2]. Recently the government launches strict implementation of regulation and mandated all government agencies to conserve power energy and tap the renewable energy abundantly present in the country [6]. The energy policy of the Royal Commission of Yanbu is the system used to address issues on energy production, distribution and local consumption. It is mandated to implement environmental policy at the industrial city of Yanbu. This is done thru the strict implementation of regulation RCER 2010 that various industries to follow as guidelines to ensure a cleaner environment and reduce CO2 emission. Likewise the Saudi Energy Efficiency Center (SEEC) was created in 2010 for development of energy efficiency and conservation policy and such regulation are now strictly implemented for any house related innovation.

## 3. Definition & Benefits

To reduce power energy consumption in Saudi Arabia the Saudi Building Council was created in 2009 to promote housing design conducive to Arab culture but at the same time ecofriendly and energy efficient. In general, housing mainly consume much of the power energy produced [3],[8]. The housing or buildings consume much energy to keep the atmosphere inside relaxed through cooling, ventilation, and heating. It needs power for the use of home appliances, lighting systems, and other electronic equipment [10]. There is a need to improve the housing design to reduce the power energy needs to prepare its spaces (cooling, heating, and ventilating).

Replacing old appliances and using the LED or CFL lamps will help in reducing the power consumption and improve energy efficiency [4], [5]. Hence all efforts were mainly focused in reducing the power consumption of housing thru house innovation and the use of power saving appliances. Most of the houses are now properly insulated and well ventilated and installed with water efficient equipment while appliances with high energy efficient rating were mostly recommended for government housing program. In 2010, appliances that do not conform to energy efficiency are now being phase out or not allowed in the market [11]. In addition some industrial waste produced was recommended for recycling and use as building materials within the kingdom. Installation of water-efficient equipment and appliances in kitchens and bathrooms were implemented to reduce water consumption

## 4. Application

4.1 Building Design- Compliant to Saudi Green Building Council Requirement
4.2 Road Network System- Smart traffic system & modern road network
4.3 City Bus Service-encourage residents to take public transportation to reduce cars on the road.
4.4 Mosque Construction- Design allows natural light and efficient use of cooling system.
4.5 Energy Efficiency & Education- promote and provide funding for project related to renewable energy.
4.6 Implementation of Sustainable Development-encourage future innovations to sustain energy efficiency
4.7 Green Regulation & Technologies - promote residents to go green
4.8 Attract new innovative technologies & select best conceptual energy efficient design-incentives are given to various industries that promote new technology.
4.9 Houses and Urban planning-ecofriendly and energy efficient houses are built in RCY to reduce waste energy and reduce power energy consumption.

## 5. Goals

In the recent survey of power consumption in Saudi Arabia, it was shown that electricity consumption is increasing and the housing sector consumes almost half of the total. As a result the government spent billions for power generation. This can be reduced if energy efficiency can be applied to all housing construction development by installing proper insulation, housing design that can use natural light rather than artificial light and optimum use of air condition for cooling. In this way power consumption in can be reduced and will save millions of dollars in saving.

Thus it is the goal of the Saudi government to tap other source of renewable energy so that by 2020, the country‘s consumption of power energy from oil can be reduce and can be exported to generate revenue. Construction of solar power has been initiated to tap this vast renewable energy [6],[7]. Likewise research had been on going in some university to tap the wind energy. The country had been replacing the use of incandescent lamp to CFL or fluorescent lamp or LED lamp. Street lamp and some communication equipment have been powered by solar. Thus it is the aim of the government that by 2020 consumption of power energy from fossil fuel will be drastically reduced as shown in Figure 1. Lately landscaping project has been expanded and implemented in the city that resulted in increase of shade. This resulted

in cooling the surrounding area since trees can absorb the heat energy coming from the sun. Although the landscaping project entails more water consumption, the RCY recycle the domestic waste water as irrigation water.

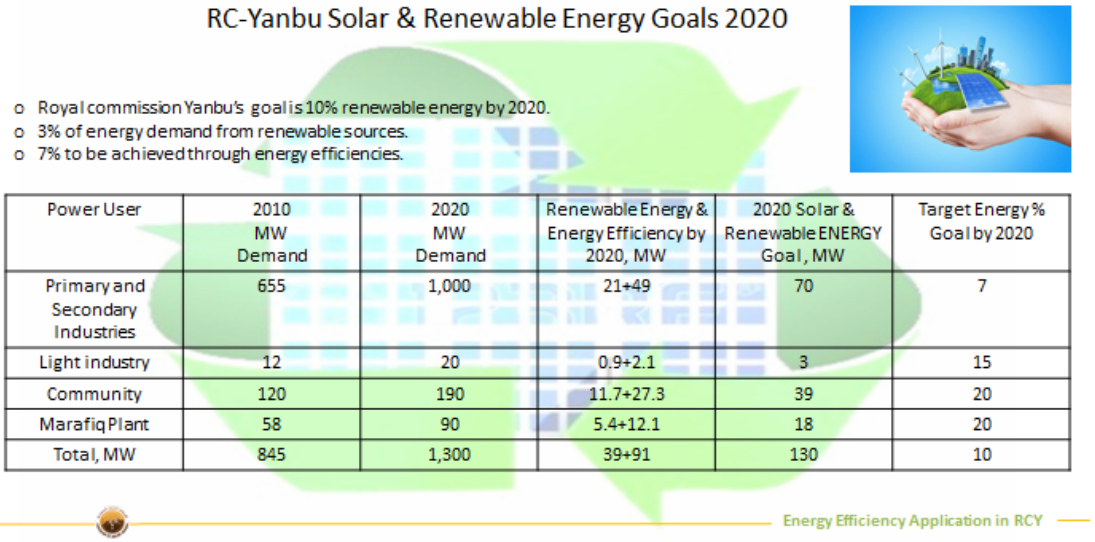


Figure 1. RCY proposed target to reduced power demand thru energy efficiency in the city.

## 6. Results

Implementing energy efficiency within the industrial city of Yanbu particularly on the housing sector will increase the value of the property since this property will be in great demand on leasing sector. In addition, the housing design with reduced power consumption will contribute in CO2 reduction as well as in maintenance cost in the future. Figure 2 shows the benefits that can be derived in reducing the power consumption.

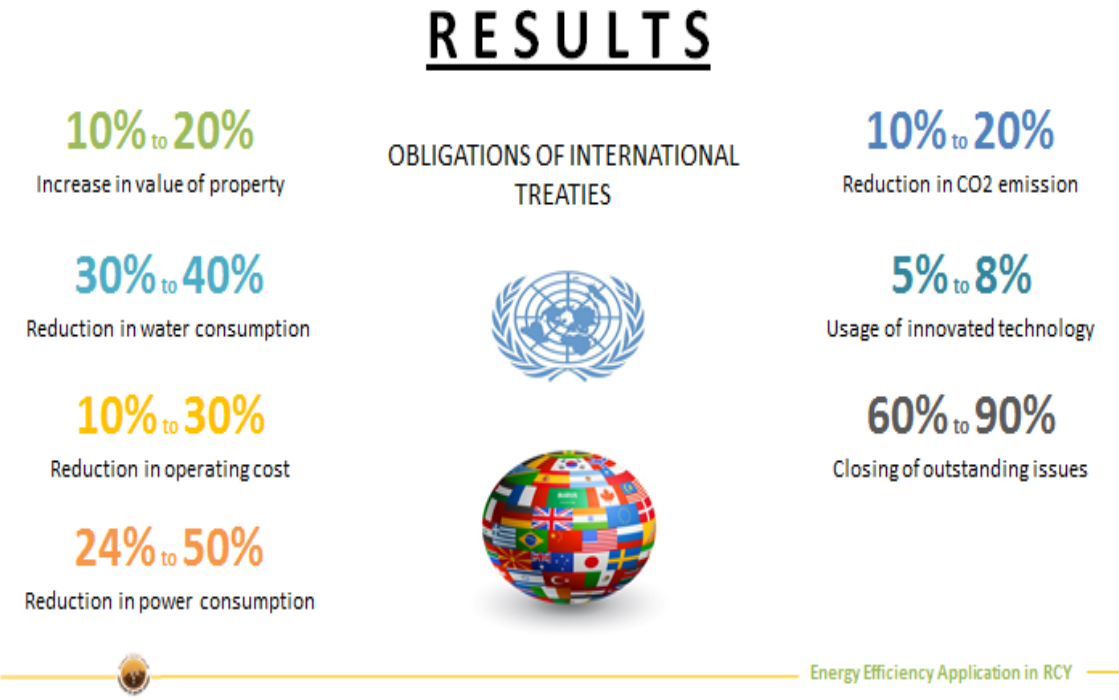


Figure 2. Result on the implementation of energy efficiency in RCY

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