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Energy Efficiency Policies and Strategies to Reduce Diesel Fuel Consumption in Saudi Arabia

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Abstract

The demand for electric energy has seen steep increase during the last decade before it started to become stable. During this period, Saudi Arabia has experienced a very large economic growth due to several factors such as increase of oil prices. However, the fall of oil prices starting on the year of 2015 has led to sharp increase of diesel fuel prices up-to to three folds inside the country. Meanwhile, primary power generation fuel source is fossil fuel based. This has put tremendous pressure on the electric utility to reduce the usage of diesel fuel. This paper presents practical policies and energy efficiency measures that help to reduce the utilization of diesel fuel and ultimately eliminate it. Analysis of several policies and energy efficiency measures is provided. Additionally, results of selected measures implementation are presented.

Keywords: Load; Energy sources; Diesel fuel; Energy consumption; Energy efficiency

Introduction

The Saudi Electricity Company (SEC) was established in 2000 to oversee all electricity infrastructures in the kingdom of Saudi Arabia. Until now, the total available generation capacity reached near 74.3 GW with 99.8% country-wide electrification. Due to the large landscape of the kingdom, the total length of transmission lines grew into 70,300 km-circular. Since the establishment of the unified electricity company in Saudi Arabia, SEC, and over the last decade, the power grids of the company's main four operating areas have been rapidly changing. These are Central Operating Areas (COA), Western Operating Areas (WOA), Eastern Operating Areas (EOA), and Southern Operating Areas (SOA) areas. The geographical areas of the north of Saud Arabia are further divided into North Western (NW) and North Western (NW) and have been administrated by Western Operating Areas (WOA). There are several transmission isolated areas, which are not connected *via* transmission system with the interconnected grid. For example: Rafha and Sharora are not connected with the interconnected system. Additionally, there are spots in the network where the distribution system is isolated [1-3]. An example of these isolated distribution systems is Al Ola and Ranya. In the early time for grid formation, these areas were developed in insolation of one another before they were unified and technically interconnected. Diverse power generation technologies resulted by different policies and procedures are existed due to the early isolation. Nowadays, areas are interconnected are ruled by one common policies and grid code.

In recent years, the network is notably expanding, and power is extended to reach more customers. Industrialization and development projects are on the rise, and the country's population growth rate is among the highest in the world. As a result, the power demand has been substantially increasing. In some years, the annual growth of electric power demand was around 10%. On the other hand, growth rate of electric power demand was low due economy restricting. In 2016, the annual growth rate of electricity demand in the past five years reached 6.7% [1]. Figure 1 shows electric peak load demand registered in Saudi Arabia from 2012-June 2017. As a result, Saudi Arabia could become a net importer of oil within more than 20 year as energy consumption extrapolated [4]. Other studies forecasted future large energy demand and expected that renewable energy including geothermal energy will play major role in energy mix [5-7].

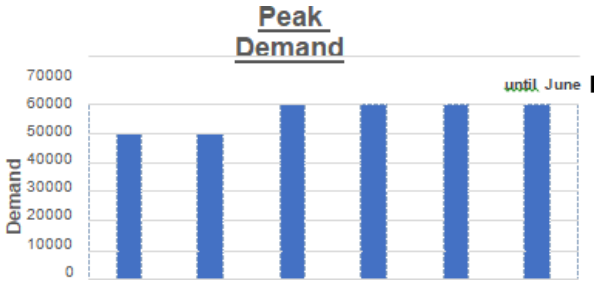

Figure 1: Peak demand [MW] in Saudi Arabia between 2012-June 2017.

Installed generation plants are attributed to cover power demand. All installed generation plants are fossil fuel based with potential plans for diversification with renewable energy resources in the future. The main fuel resources used are heavy fuel oil, natural gas, crude oil and diesel. Considerable number of onsite and distributed generations at the load side are powered by diesel. Detailed information of the number of power plants powered by every fuel type, number of units, and total power generation is presented in Table 1.

No of power plants	Main fuel type	No of units	Capacity (MW)
34	Diesel	270	8043
14	Crude	244	13735
3	Heavy	24	9910
13	Gas	181	20476

Table 1: Fuel based power plants distribution for 2015 in Saudi Arabia.

In the beginning of 2016, energy fuel prices have gone up in Saudi Arabia, in particular, diesel fuel. This steep increase in the diesel fuel price along with environmental impact has increased the need to lower the dependency and usage of diesel as possible. On the other hand, diesel fuel is commonly agreed that it produces high level of undesirable amount of emission. Further, the quality of the emission

produced by diesel is very poor comparing with for example natural gas. The need for eliminating the diesel utilization as power generation fuel source has become more substantial especially with the suite of economic diversification and clean energy initiatives that are based on Saudi Arabia 2030 vision.

For a similar prospect, an analysis has been carried of various policies for the transportation sector. These polices and measures help reducing oil consumption and greenhouse gas emissions [8,9]. In Malaysia and China, greenhouse gas reduction progress has been investigated and green based initiative has been reported by Chua [10-12]. Similarly, energy related polices in Denmark have been analyzed to unveil the implications of such policies on global energy security and sustainability [13]. Policies and measures are proposed to advanced energy efficiency, reduce fossil fuel, and increase renewable energy penetration in Brazil [14]. In Russia, energy efficiency resources have been quantified and reported in [15].

Energy efficiency measures have become instrumental bridges for energy transitions [16]. Industrial energy efficiency measures are indicated to be considered as first step toward energy mix in Saudi Arabia [17]. In Matar [18] present a discussion on energy subsides and energy price reform with a background of energy consumption in Saudi Arabia. Industries propose using energy storage systems to lower diesel fuel dependency and variable speed. To lower Saudi Arabia's fuel consumption and energy system costs, the diesel fuel usage has been proposed to be eliminated except in special needs such as system and generation units black out restoration. This energy efficiency measure was identified to help in making the environment better. Toward this goal, several policies and strategies have been proposed and implemented. This paper identifies the problem of diesel fuel dependency. Also, this paper identifies policies and procedures to eliminate the dependency of diesel fuel and presents analysis and implications of these policies on the system economics.

Analysis of Current Diesel Fuel Consumption in Saudi Arabia

The economics of diesel fuel

With the steep increase of power generation fuel price, energy stakeholders in Saudi Arabia have decided to lunch several energy projects such as generating energy by renewable resource. Table 2 presents different fuel prices before and after the increase in the year of 2016.

The prices of fuel have increased by 67%, 83.0%, 50.0%, and 289% for natural gas, heavy fuel oil, crude oil, and diesel, respectively. Although prices for all different fuel types have experienced increase, diesel fuel price, in particular, has been significantly increased.

The increase was more than three folds the old fuel price. This large increase is attributed to several reasons. The first reason is that the very limited resources of this type of fuel. Another reason is that the increase of diesel fuel in the international market has spurred local suppliers such as Saudi Aramco to trade their diesel fuel capacity internationally.

Fuel		Diesel	Crude oil	Heavy Fuel Oil (HFO)	Natural gas
Prices before change	$/BRL	3.6	4.24	2.08	
	SR/BRL	13.5	15.9	7.8	
	SR/ MMbtu	2.5	2.95	1.21	2.81
Prices after change	$/BRL	14	6.35	3.8	
	SR/BRL	52.5	23.81	14.25	
	SR/ MMbtu	9.72	4.42	2.21	4.69
		289.00%	50.00%	83.00%	67%

Table 2: Fuel prices before and after increase in 2016.

On the other hand, economically, replacing the production of 1 MWh from diesel to cured oil for example was found to save about 21,000 diesel barrels and SAR 600,000 annually. For example, converting one generating unit from diesel fuel to secondary fuel would save 820 MMBtu/MW. All of these reasons have put pressure on the utility provides to identify all possible means of energy efficiency measures to help reducing and ultimately eliminating the use of this type of fuel.

Diesel fuel distribution

The diesel fuel consumption in Saudi Arabia is analyzed through three different aspects as follows:

Utilizatiztion: The outlook of power generation fuel sources is dominated by fossil fuel with the large number power plants is operated by diesel. Out of 719 power generation units,

37.5% of these units are powered by diesel with total capacity of 8043 MW.

One the other hand, Table 3 presents information related to diesel fuel distribution as the source utilization type in Saudi Arabia. Around 15.5% of the power is generated by units that diesel fuel is considered to be primary fuel type. This is amounted to be 8043 MW. Additional, the utilization of diesel fuel as a startup source accounts for 57% with total of 571 generating units. Also, diesel fuel is used to power 389 units as a backup source. These numbers conclude the level of utilization of diesel fuel.

Diesel fuel as	No of power	No of units	Capacity (MW)
Main fuel	34	270	8043
Start up	44	581	36030
Back up	29	389	18911

Table 3: Diesel use distribution as source in Saudi Arabia.

Operating areas: Data has been gathered from all electrical operating areas regarding the current status of diesel fuel consumption across by every electric operating area the country for the year of 2015. Figure 2 presents diesel fuel consumption for every operating area in the system. The area ranking from top to bottom in terms of diesel fuel consumption is also presented in Table 4.

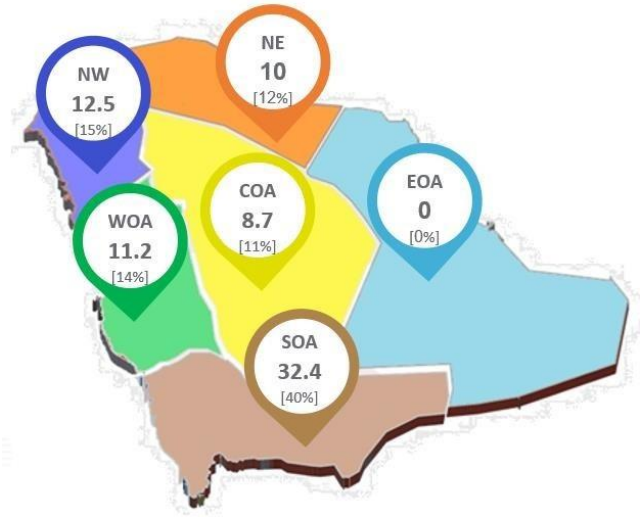

Figure 2: Diesel fuel consumption by operating area in 2015.

S.No	Area	Percent of totalfuel consumption	Million barrel
1	SOA	40.00%	32.4
2	NW-WOA	15.00%	12.5
3	WOA	14.00%	11.2
4	NE-WOA	12.00%	10
5	COA	11.00%	8.7
6	Isolated distribution and summer support	8.00%	6.6
7	EOA	0	0

Table 4: Distribution of diesel fuel consumption in 2015.

Analysis of every operating area where diesel fuel consumption is high reveals that both SOA and NW area of WOA are among the highest diesel fuel consumption in the country 40% and 15%, respectively. On the other hand, EOA has reported that no diesel fuel consumption has been consumed in 2015 and it has successfully eliminated the use of diesel in power generation plants. During summer, Saudi power grid becomes stressed due to the large cooling load that goes along with the environmental condition. In summer, transmission system, sometimes, becomes congested and may require local energy support. This requires operating units locally; mostly are diesel powered units. It should be noted that isolated distribution systems and local summer energy support using diesel fuel was found to account for 6.6 million barrels, which is equivalent to 6.6% of the total diesel fuel consumption. Total number of diesel fuel barrel used in 2015 for energy production in the country was 81.4 million barrels.

Sub-opearting and isolated areas: After thorough analysis that was done to locate power plants that heavily consume diesel fuel, it is found that most of power plants are located in SOA and WOA. All locations that consume diesel fuel are presented in Figure 3 and classified by their electrical connection. Isolated distribution means that the network is isolated at the distribution system but connected at the transmission system. On the other hand, isolated transmission means that the network is isolated at the transmission but connected at the transmission system. The number of diesel fuel barrels consumed in the interconnected system, isolated transmission, isolated distribution, and others start up and mobile power generation units is 53.2, 20.5, 3.1, 4.1 million barrels. Additionally, it is found that around 50% of the total number of diesel fuel barrels used in 2015 is consumed in four power plants: Jazan, Tabuk PP2, A sir, and Jeddah PP3.

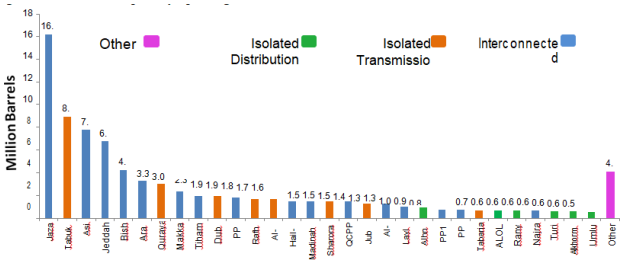

Figure 3: Distribution of diesel fuel consumption in 2015 by sub-areas.

Proposed and Development of Energy Efficiency Measures

Energy efficiency has been one pillars of the Saudi energy policy toward energy mix and diversification. During the last dedicated professionals working on improving energy efficiency in the country throughout initiatives. SEEC energy efficiency initiatives have focused on the following areas: Commercial and governmental buildings, capacity building, labeling, industrial facilities.

Power plants fuel cost reduction is one of the industrial facilities goals. The main goal here is to defer the need for diesel fuel as a power generation fuel source. This would require allocating cleaner fuel source, which is environmentally friendly and at the same time cost less. To reduce the use of diesel fuel and gradually eliminate it, a set of policies and energy efficiency measures are proposed to be implemented across the premise of SEC.

These measures can be as simple as energy conservation techniques such as conducting proper maintenance to the costliest and need technical infrastructure modifications. Below, these policies and energy measures are listed briefly:

Power plants merit order update

A merit order is a traditional and basic method to rank power generation units based on price of generation in an ascending order. To reduce the dependency on diesel fuel. The merit order list of power plants should be updated to include the new price of diesel fuel. As a result, diesel fuel-based units will be placed in the end of the list. This will ensure that these units will be rarely operated. Merit order technique is simple yet not efficient. So, there are many other economic dispatch techniques that are considered to be more effective than merit order. National grid, a transmission company owned by SEC, is considering alternative techniques. Furthermore, SEC has plant to implement an advanced economic dispatch that considers the transmission system architecture to perform optimal economic dispatch in the near future.

Fuel replacement procurment

Saudi Arabia is abundant with most of fossil fuel sources making it very competitive in terms of price when comparing to diesel fuel. Fuel accounting suggests the reduction in the use of diesel will need to be compensated by an alternative and available type of fuel such as crude oil and natural gas. Crude oil, however, is abundant and is considered to be cheap comparing with other fuels as provided in Table 2. The new amount is estimated and planned to be procured from suppliers is Saudi Arabia.

List duel and more fueled units

The characteristics of boilers allow for more than one fuel source such as diesel, heavy crude oil, and natural gas. This characteristic allows the utility to duel accounting to switch from one fuel source to another when there is a change in the fuel prices. To help reducing diesel fuel use, a list of units that can be fueled with two or more different fuels was compiled. Then, technical issues are determined for energy unit when switching from diesel fuel. If the situation permits, units are switched immediately away from diesel fuel utilization to a cheaper option.

Stop fuels blending and operate units with one fuel

Some power generation units can be fueled by a blended of two different types of fuel. This is somehow a common exercise for some utilities around the world. Locally, diesel fuel is usually mixed with another type of fuel such as crude oil. This practice is usually carried out to achieve lower operating costs, improved power density of the unit, and lower output emissions. As a step toward diesel fuel elimination, all duel fuel units should be switching to a second fuel type than diesel.

Unit engine wash plan

Power engine washing is vital for maintaining unit performance and longevity. Unfortunately, unit engine washing has not been considered at local utilities and considered seriously. However, this practice has been approved and a plan has been developed to conduct unit washing periodically at SEC. This is in particular true for units that are fueled by diesel and crude oil. This measure will help achieving higher unit performance and operation improvement. Additionally, washing these units will allow units to generate at maximum designed level.

High priority to non-diesel power plant ongoing and future projects

Due to the last decade typical yearly demand increase, SEC has ongoing and future plans for new power generation units. However, with the demand is being flatten during last years, some of these plans have changed. However, it is crucial to proceed with plans that help reducing diesel consumption and these kinds of projects, in fact, should be given a priority.

Installation of Special Protection Schemes (SPS)

SPS is an excellent protection scheme that can detect predetermined system abnormal conditions such as congestion and consequently take correction actions that meet the grid code. The isolation of the faulted components action is usually excluded from these actions. In case of a major component loss such as generator or power transformer, SPS executes a predefined corrective action by isolating part of the grid. This kind of protection scheme allows the system to avoid interruptions and blackout. As a result, the need for running unnecessary diesel units is reduced substantially.

Load redistribution at the distribution system

Early generation plants installations used to be connected to the distribution system to directly feed the load. Throughout the past decades, the Saudi electrical grid has experience large development. During the expansion of the grid, these old power plants were isolated from being connected to the transmission system and kept connected to the distribution system. These aged plants are commonly fueled by diesel. All these units are old and due retirement. So, SEC has recognized the importance of expedite the retirement process to be able to save in diesel. At the same time, the load will be reconnected with the nearest transmission substations.

Implementation of Diesel Fuel Reduction Measures

Diesel fuel reduction measures

Measures outline in the previous section are going through implementation. This section reports about completed projects and implemented actions. The main goal of this implementation is to achieve reduction in diesel fuel utilization. These measures are as follows:

Power plants capacity support: Old, nearly retired, and diesel fueled units are replaced by newly installed generating units. For example, in 2016, an additional of 4245 MW capacity has been added to the system. In particular, eight efficient generation units have been commissioned in power plant number 12 (PP.12) located in Riyadh with an equivalent capacity equals 1360 MW. The impact of this additional capacity on diesel consumption is in two folds:

- It would reduce the energy transfer used to require from neighboring operating areas and
- Increase the overall system efficiency.

Another example of new capacity support is the additional of four efficient generation units at Jeddah South Power Plant (JSPP). The total capacity of these units is 2800 MW. This capacity addition comes with several advantages: It would alleviate the need to make the power plant with its old units, power by diesel, on bar all the time due to high demand. Additionally, it would allow the system operator to reduce the required energy supplied by low efficient units in the area. Moreover, this additional capacity would facilitate the system to increase energy transfer to the SOA, which is fully dependent on generating units fueled by diesel. Thus, dependency on diesel fueled units in SOA is reduced.

Transmission system and interconnection capacity support: Commissioning of 380 kV Assanabil-HP2 Double Circuit Transmission Line: One of the major power plants that are old and use diesel fuel very heavily is Jeddah south power plants number 3. To allow for some diesel fuel relief in the plant, a 380 kV double circuit Assanabil-HP2 is set to in full operation. This would save plenty of diesel fuel.

Commissioning the 3rd interconnection WOA-SOA: There does exist an interconnection between WOA and SOA through two transmission lines with maximum transfer capacity equals 1800 MW. The interconnection is supported by a third transmission line that

connects between Taif East and Bisha specifically. The amount of energy that is transfer through this new line helps to decrease power generation from units fueled mainly by diesel at the south area.

Commissioning 380 kV Rabigh-East Al Madina Al Munawara Double Circuit Transmission Line: In Al Madina Al Manwra city, which is part of WOA, there is a power plant operated by diesel fuel. Since it is completely dependent on diesel fuel, a complete shutdown is necessary. This can be achieved after the commissioning of a 380 kV double circuit transmission line that connects between Rabigh-East of Al Madina Al Munawara. When the power plant is shutdown, energy capacity can be provided through these double circuits from plants that are cleaner.

Install Special Protection Scheme (SPS) at SOA: SPS is an automatic protection tool that is part of fast remedial actions which can be executed to not only to clear the fault but also takes corrective actions to maintain high level of system reliability. This type of protection scheme has been widely in the power system. In the south operating area, SEC has installed one SPS to monitor and act in five different predefined cases. This installation helps avoiding the need for running many diesel fuel units in the south operating area when there are interruptions.

Duel fueled units: Units that inherit the capability to be fueled by diesel and another fuel are considered for diesel fuel replacement. In 2015 for example, Arar sub-area consumed 3.3 million barrels. During the year of 2013 and 2014, four units were switched from utilizing diesel fuel into the secondary fuel type. This results to noticeable efficiency improvement. These four units are located in the north part of Saudi Arabia, where significant diesel utilization is.

Load Management at Riyadh: Riyadh is located in the COA. There is large diesel fuel consumption at the fourth power plant located in the center of the city. The power generated by this power plant is feeding directly loads at Al malaz area. To allow for a complete shutdown for this power plant, loads are connected to surrounding distribution network. Figure 4 (a-b) shows the fourth power station before when it used to supply the load directly. Future plan is to complete turn off this power plan and connect its load to the transmission system.

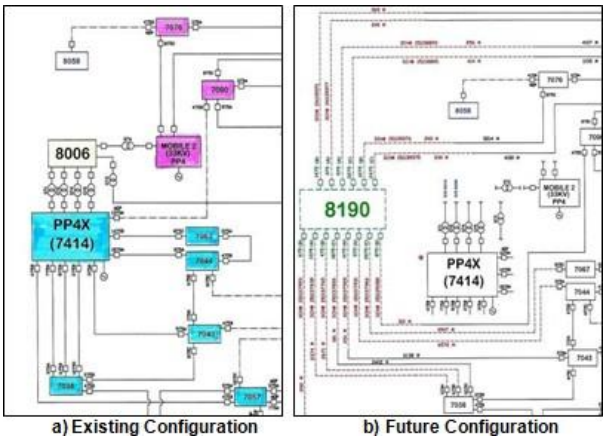

Figure 4: Current and planned configuration to redistribute the load.

Measures implementation results analysis and discussion

Analysis of operating areas after most of measures and projects related to diesel fuel reduction are implemented in 2016 reveals that the total number of diesel fuel barrel used in 2016 for energy production in the country was reduced by 16%. This is an equivalent to 13.1 million barrels. Economically, this made saving of about SAR 376 million. Figure **5** shows diesel fuel consumption by operating area in 2016. The area ranking from top to bottom in terms of diesel fuel consumption in 2016 is presented in Table 5**.** A significant diesel fuel reduction is gained at COA; the diesel fuel use reduction is equivalent to around 75%.

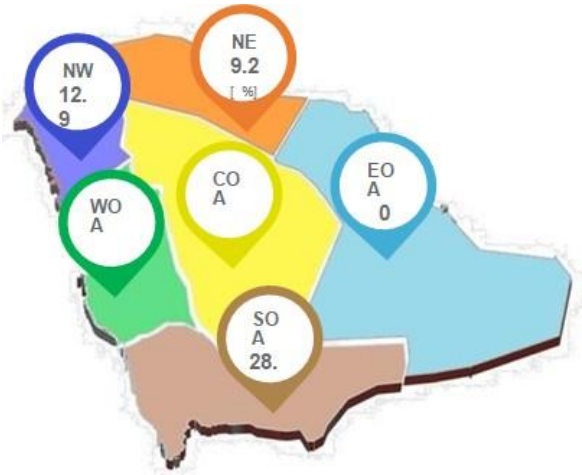

Figure 5: Diesel fuel consumption by operating area in 2016.

Area	Percent of total fuel consumption	Million barrel
SOA	42.00%	28.7
WOA-NW	19.00%	12.9
WOA	13.00%	8.8
WOA-NE	13.50%	9.2
COA	3.00%	2.2
Isolated distribution and summer support	9.50%	6.5
1EOA	0.00%	0

Table 5: Distribution of diesel fuel consumption in 2016.

The distribution of diesel fuel consumption in 2016 at all locations is presented in Figure 6**.** This distribution is classified based on their electrical connection configurations: isolated distribution, isolated transmission, interconnected system, and other. The reduction percent of diesel fuel barrels consumed in the interconnected system and isolated transmission are as follows: 26.1% and 1.0%, respectively. On the other hand, diesel fuel consumption is increased at isolated distribution by 30% due to demand increase and delayed interconnection projects. In 2016, it is still that around 50% of the total number of diesel fuel barrels is consumed in four power plants: Jazan, Tabuk PP2, Asir, and Jeddah PP3.

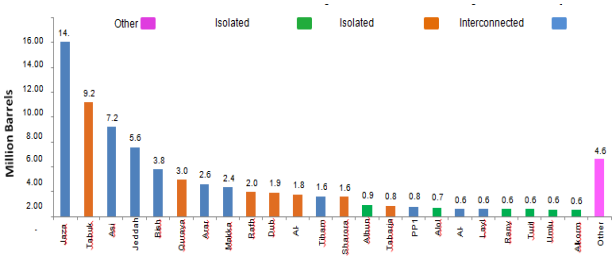

Figure 6: Distribution of diesel fuel consumption in 2016 by sub-areas.

Comparison of diesel fuel consumption between 2015 and 2016

Countrywide, diesel fuel consumption has been decreased by 16%, equivalent to 13.1 million barrels. Figure 7 presents information regarding diesel fuel usage in 2015 and 2016 based on operating area.

All operating areas experienced decreased in diesel fuel consumption except WOA-NW. The largest reduction is seen in the central region.

This is mainly attributed to the complete shutdown of the fourth power plant, demand increase, and delayed strengthen interconnection transmission lines.

The western region experienced 21% reduction; on the other hand, SOA and WOA-NE achieved 11% and 8% reduction, respectively. Last, diesel fuel consumption at the isolated distribution achieved modest reduction equivalent to 1.5%. In contrast, the WOA-NW is experienced diesel fuel consumption increased by 3%.

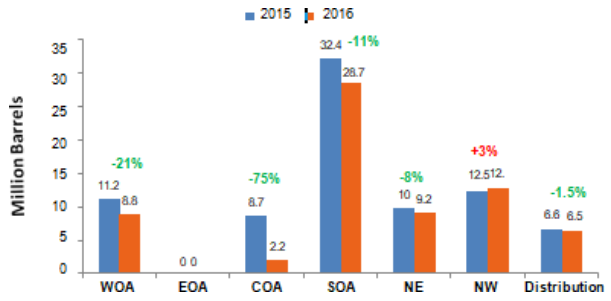

Figure 7: Diesel fuel consumption comparison between 2015 and 2016.

Fuel based energy produced comparison between 2015 and 2016

Amount of energy produced nationwide using different fuel types for both years of 2015 and 2016 are presented in Figure 8**.** The amount of energy produced using diesel fuel has been decreased by less than a third of what it was on 2015.

This is a step forward to eliminate the use of diesel fuel completely in the system. Figure 8 also shows that energy produced by other fuel types has been increased to offset the reduction of diesel fuel.

Energy produced by natural gas has increased by 7.6%, Heavy Fuel Oil (HFO) by 53.2%, and crude oil by 14%.

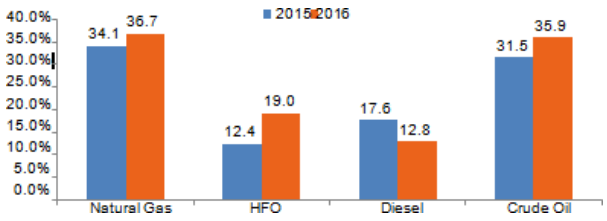

Figure 8: Fuel based energy produced comparison.

Current and Future Diesel Fuel Reduction Measures and Expected Cost Savings

Current and ongoing projects

Current and ongoing projects and policies that are expected to contribute heavily to diesel fuel reduction are listed as follows:

Commissioning shuqaiq steam power plant: To achieve diesel fuel consumption reduction at SOA, Shuqaiq power plant, a steam turbine based, is planned is commissioned. The plant capacity is 2640.0 MW. This capacity can greatly contribute to the diesel fuel saving after the commissioning.

Commissioning 380 kV KMT-HVP double circuit transmission line: In WOA, Jeddah South PP3 is one the largest plants that the only fuel that can be used there is diesel. After the commissioning of 380 kV KMT-HVP double circuit transmission line, Jeddah South PP3 can be fully shutdown.

Completion of WOA-NE area and interconnected system interconnection: One of the efforts to reduce diesel fuel in WOA-NE. This area is interconnected with the national grid. So, diesel fueled units can be shut down and cheaper energy can be imported from the national grid.

Completetion switching duel fueld units: As a complete list has been prepared previously, work is undergoing to switch duel fueled units to crude oil instead of diesel. Specifically, 6 units in Qurait PP, 3 units in Tabuk PP, and 3 units in Rafha are expected to be completed in the near future.

Comissioning 380 kV Bisha-Namira circuit transmission line: Another important ongoing project that would reduce diesel consummation in SOA is the commissioning of the 380 kV Bisha-Namira circuit transmission line. This will allow to import extra energy from WOA to SOA that are produced using fuel other than diesel.

Comissioning 380 kV Madaya high voltage substation: Madaya is a 380 kV substation located at SOA. Commissioning this high voltage substation allows for reducing energy produced by diesel fuel in SOA.

380 kV interconnection Tabarjel-Tabuk: To reduce diesel fuel consumption at both WOA-NE and WOA-NW areas, a commissioning of a 380 kV transmission line is undergoing. This line connects Tabarjel and Tabuk area.

Inteconnect Duba-Tabuk and comissioing units 1 and 2 at Duba Green: To displace units fueled by diesel, Duba Green power plant is planning for commissioning this year. This new power plant is designed to be connected with Tabuk *via* four 380 kV transmission

lines. The first line crosses over 150 km reaches Tabuk central station. Duba station output capacity is over 600 MW including 50 MW renewable energy. The plant has the capacity to generate power needed to supply around 600,000 typical Saudi homes. The plant consists of highly efficiency two units with high reliable F-class gas turbines with Heat Recovery Steam Generators (HRSG) as an extra energy efficiency measure.

Fully Running Rania, Turuba, and Kurma high voltage substations: In the national grid, there are few number isolated generation plants. These isolated generation plants are generally fueled by diesel. To reduce diesel consumption, several important high voltage substations are soon to be in full operation. These are Rania, Turba, and Kurma. These will allow these isolated loads to be fed by the interconnected system.

Expected cost savings

Economic analysis after measures and projects related to diesel fuel reduction are implemented in 2017 reveals that it is expected to gain further saving and lower emission. It is anticipated that the total number of diesel fuel barrel used in 2016 for energy production in the country was reduced by 16.9 million barrels equivalent to 25% reduction comparing to the number of diesel barrels in the previous year. As a result, this is expected to provide saving of about SAR 484 million equivalent to about 130% increase comparing with the previous year saving.

Conclusion

Although fuel prices are low in the international market, in Saudi Arabia, fuel prices have increased tremendously. In particular diesel fuel has increased about three folds, which puts large pressure on SEC. Additionally, diesel is known with high emission comparing with other fuel types. As a result, SEC is determined to reduce and then completely eliminate this type of fuel at the electric network. Considerable progress has been made toward the development of policies and procedures to ensure the reduction of diesel fuel consumption over the coming years. In addition, SEC has rolled out a series of infrastructure projects that will help achieve that goal. Early results of these policies, procedures, and projects have shown significant amount of diesel fuel saving. Over the last two years, the number of diesel fuel barrels that have been reduced is 30 million. This is equivalent to about 37.0% of the total number of diesel fuel barrels consumed in 2015. Moreover, this reduction has saved SAR 860 million.

Work is underway to continue reduce the dependency on this highly priced type of fuel until it is fully eliminated from the nation grid fuel mix. In fact, SEC has put a goal to eliminate the usage of diesel fuel from its portfolio except in restoration procedure. With the country ushering to embrace renewable energy, with an ambitious and daring goal constitutes of 9 GW is produced by renewable by 2023; diesel fuel elimination can be achieved as renewable energy generation resources will displace these diesel fueled units.

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