STUDY

Towards Sustainable Energy Efficiency in Iraq

Iraq has been facing a severe power crisis since 2003 and is projected to surge in the long run.

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Summary

Iraq has been facing a severe power crisis since 2003 and is projected to surge in the long run. Efforts so far had been focusing on the supply side, while neglecting an equally important aspect of improving the energy efficiency on the demand side. The technical and commercial losses exceed 50 percent of the generated power. The majority of the losses are in the residential sector, which represents the highest energy consumer from the demand side. This report discusses the current status of energy efficiency in the residential sector of Iraq including policies and regulatory setup. The institutional, financial and technical barriers are discussed which could form an overarching basis to the core principle of transition towards a common vision of environmental protection, emissions reduction, resource efficiency, security of supply and consumer protection.

1. Introduction

The fall of global oil prices due to COVID-19 has created staggering economic problems for Iraq. In April 2020, revenues barely reached $1.4 billion while Iraq needs $5 billion to cover basic spending including public sector salaries, pensions, food rations and other essential expenditures[1]. Iraq's economic outlook in the near future looks bleak unless the newly appointed government takes unprecedented reforms to diversify the monothetic oil-based economy. The huge deficit in the 2020 budget is impeding Iraq's ambitious plan to upgrade its energy sector, including the power system, which has been facing serious crisis since 2003. Initially, electricity shortage was due to insufficient generation capacity; but became more prevalent to include restrictions in power transmission and high technical and commercial losses in the distribution network exasperated by Iraq's high growth rate in demand[2]. The residential sector is the major consumer of electricity which represents 48.3 percent of the total number of consumers (Figure 1). Because of the unreliability of the electricity supply from the national grid, neighborhood diesel generators operated by private owners became very common selling electricity at eight-fold the average residential electricity price anywhere in the Middle East region[3]. The distribution network losses are compounded since 2003 by the high levels of unmetered consumers and the absence of effective billing systems, which in turn led to widespread theft and illegal connections. In addition, there is a high level of non- or under-collection of billed electricity[4].

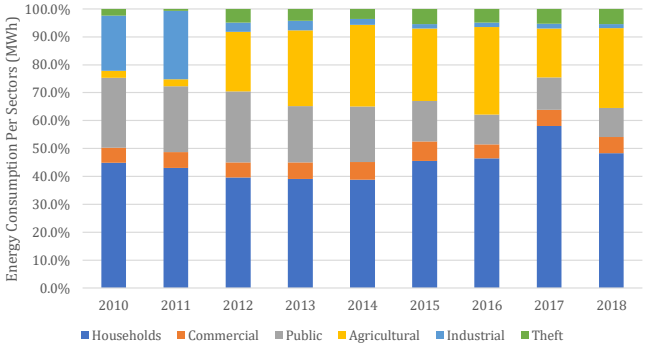

Figure 1 – Electricity Consumption per Sectors (2010 – 2018) [Source: MoE, Author's analysis]

1. The oil sector dominates the economy, even by regional standards. Despite volatile security conditions, oil production has tripled since 2003. The sector accounts for over 65 percent of GDP, 90 percent of central government revenue, and nearly 100 percent of the country's exports (Source: The World Bank (2018), "Iraq Economic Monitor From War to Reconstruction and Economic Recovery", Spring http://documents1.worldbank.org/curated/en/771451524124058858/pdf/125406-WP-PUBLIC-P163016-Iraq-Economic-Monitor-text-Spring-2018-4-18-18web.pdf
2. Iraq's peak demand for electricity has grown from 6,721 MW in 2003 to 27,346 MW in 2018.
3. According to Baghdad Provincial Council, there are more than 13,000 registered private and government owned neighborhood generators in Baghdad alone. The price of the electricity provided by the neighborhood generator to consumers is much higher than grid electricity. This price is currently ranging between $6.50 for six hours per day to $10 per ampere for 24 hours, which equates to US¢ 8-17/kWh. The neighborhood generation provides less than 15 percent of electricity consumed but captures more than 90 percent of household spending on electricity (Source: IEA (2019), Iraq's Energy Sector: A Roadmap to a Brighter Future).
4. According to the Ministry of Electricity, the produced energy by the power station in 2018 was 106x109 kWh while the sold energy to the consumer was 39x109 kWh.

The increase in supplied electricity to the provinces except KRI has gone up from 38.62 TWh in 2010 to 105.8 TWh in 2019 (Figure 2). The spectacular increase in use of electrical appliances and heavily subsidized tariff of electricity with no enforcement from the government on the consumers to pay the electricity bills are among many reasons for the increase in electricity consumption[5]. The effort to increase power generation was obviously not enough to fill the supply-demand gap as demand has kept staggering at the rate of 7 – 9 percent per annum.

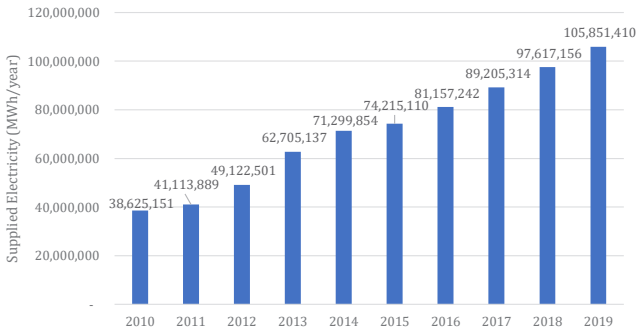

Figure 2 – Supplied Electricity by the MoE (2010 – 2019) [Source: MoE]

The government efforts for energy efficiency (EE) have been greatly neglected and not considered as part of solving the electricity shortage, as the focus remained on increasing the generation capacity with little attention paid to reduce the demand induced by consumers. Since 2005, the emphasis was to build more gas turbine power plants due to their high efficiency and relatively fast construction period compared to other methods of power generation (Figure 3). There was less emphasis on renewable energy although the government has announced in May 2019, a plan to install 755 MW by end of 2020. However, the program has been setback due to the country's economic crisis and COVID-19 pandemic.

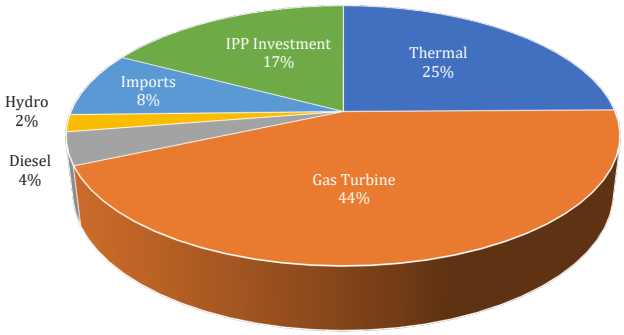

Figure 3 – Generation mix in 2019 [Data Source: Ministry of Electricity]

Undoubtedly, the power shortage is expected to continue unless tangible measures are taken on the consumer-end to reduce the technical and commercial losses with more attention to be paid for application of EE as part of national energy policy. The potential for EE in Iraq might reach 18,070 ktoe (210.15

5. The number of subsidized customers has increased by 30 percent since 2010. Efforts to reduce subsidies to offset the burden of the increasing number of customers suffered a setback when further subsidized tariffs were introduced in 2018 (see below table for details). All residential customers, regardless of their total consumption are subsidized at the same rate for the same level of consumption. The bulk of the subsidies (approximately 48 percent of the paying consumers) are supporting the non-poor with consumption exceeding 1,500 kWh per month (Source: Istepanian, H. (2020), Residential Electricity Subsidies in Iraq: Exploring Options for Reform, Iraq Energy Institute, UK, March).

Category	Monthly Consumption range in kilowatt-hour (kWh)	Tariff (IQD per-kWh)
Residential	1 - 1,500	10
	1,501 - 3,000	35
	3,001 - 4,000	80
	4,001+	120
Commercial	1 - 1,000	60
	1,001 - 2,000	80
	2,001+	120
Industrial	All	60
Governmental	All	120
Agricultural	All	60

GWh) per annum by 2025 (Figure 4), mostly in the electricity sector (73.3 percent)[6].

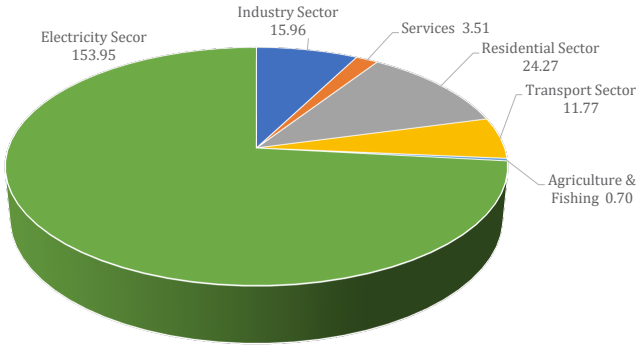

Figure 4 – Iraq Potential Energy Efficiency (TWh/year) by 2035 [Source: World Bank, 2016]

Energy efficiency and conservation cannot be properly applied if only left to the households, as most consumers are not well informed of tangible and intangible benefits of EE. Their contribution will be minor unless they are sheltered under a larger policy for energy management. The role of the government is vital in terms of intervention to provide an effective energy efficiency strategy and conservation program that can sustainably contribute in solving the electricity shortage through reduction in energy usage with less dependence on fossil fuel power generation.

2. Aggregated Technical and Commercial Losses

There is no mistaking that the aggregated technical and commercial (AT&C) losses of the electricity network in Iraq are the biggest challenge for the Ministry of Electricity (MoE), affecting the entire grid operational efficiency and significantly obstructing any tariff reform[7]. AT&C losses have increased from 28 percent in 2003 to 58 percent in 2018 (Figure 5)[8].

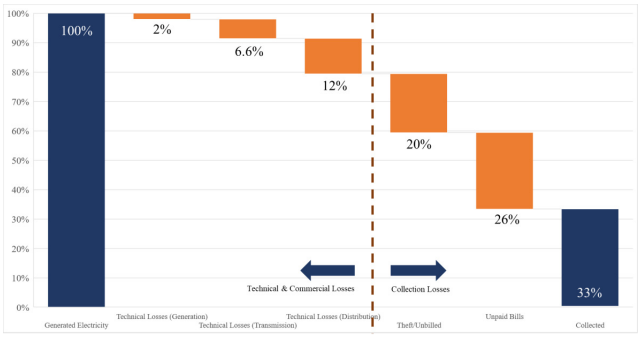

Figure 5 – Technical and commercial losses (Data Source: MoE, 2017)

Analysis using the MoE's data from 2018 confirms that a 10 percent reduction in losses would produce IQD 1,145,256 million (US$ 958.37 million) reduction in the total magnitude of the financial subsidies[9]. The major AT&C losses including under-billing, poor collection, and electricity pilferage are among most significant avoidable cost items especially in Baghdad (including Karkh, Rusafa and Sadr city) and Basra, which account more than 46 percent of AT&C losses (Figure 6).

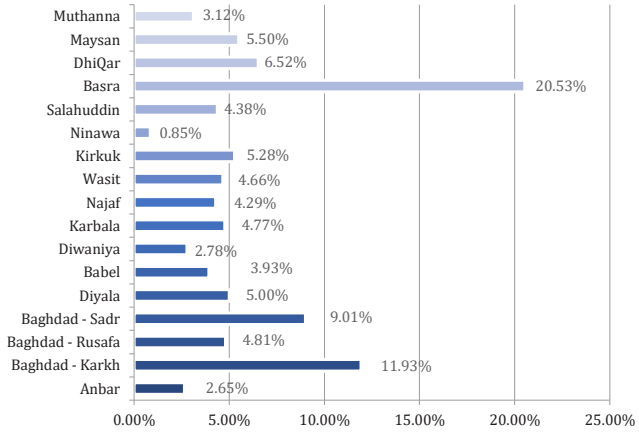

Figure 6 – Distribution of AT&C losses among provinces (excl. KRG) [Data Source: MoE, 2017]

6. The World Bank Group (2016), "Delivering Energy Efficiency in the Middle East and North Africa Achieving Energy Efficiency Potential in the Industry, Services and Residential Sectors", May (Link)
7. Ministry of Electricity, Development of a Reform Roadmap for the Electricity Distribution Sector in Iraq (Baghdad: MoE, 2015. Authored by CPCS).
8. This is combined with low collection rates of the total energy billed and translates into a total commercial loss of above 70 percent of the total electricity generated. In well-managed power systems, AT&C losses are normally not exceeding 10 percent.
9. Istepanian, H (2020), 'Residential Electricity Subsidies in Iraq: Exploring Options for Reform', Iraq Energy Institute, UK, March (Link)

The MoE, with technical assistance from the World Bank, developed in 2015 a Non-Technical Loss Reduction Strategy (NTLRS), which included several prioritized actions to address the sector's high commercial losses, centered on revenue management operations including two main elements of billing and collections efficiency[10]. The MoE has initiated some actions among which were (a) installation of a new billing system; and (b) outsourcing of revenue management services (also known as Collection and Service Contracts (عقود الخدمة والجباية) for meter reading and electricity sales revenue collection. The latter also involved the installation of smart meters at selective consumer premises. In addition, the Council of Ministers (CoM) has issued a directive (Order No. 12 of 2018) which aimed to improve revenue collection of supplied energy to about 80 percent of consumers. Despite all of the above, the losses kept compounding and it appears Iraq won't be able to resolve the unprecedented commercial losses unless the technical losses are resolved first including replacement of the end-users' outdated and malfunctioning meters, widespread theft and unmetered connections[11].

3. Electricity Billing and Collection

The consumers in Iraq tend not to trust the accuracy of their electricity bills, which contributes to their reluctance to pay the bills. Investment in capacity to read meters and a clearer presentation of the bills themselves should be a priority[12]. The government needs to take additional steps to make subsidies clearer on electricity bills and to photograph meters when read to bolster transparency. Such efforts should be evaluated and successful approaches should be replicated across all distribution companies. The current utility bill (Photo1) should be restructured to show the amount of subsidy as a common percentage of discount to the overall bill. The utility bill design should be refreshed to make it easier for customers to manage their bills and monitor power usage. Such measures will reshape customer service, assuring a minimum level of quality, a wide choice of payment methods and control of their usage. Good service and good products will lead to positive customer satisfaction, improving loyalty and confidence in the government departments. The distribution companies need to bolster their customer service mechanisms, including setting up dedicated customer service centers, websites, social network and mobile phone applications for lodging complaints. These customer service mechanisms could be strengthened to effectively and rapidly respond to queries and complaints. The MoE could encourage the distribution companies to experiment with these techniques by rewarding the best performers and publicizing their approaches.

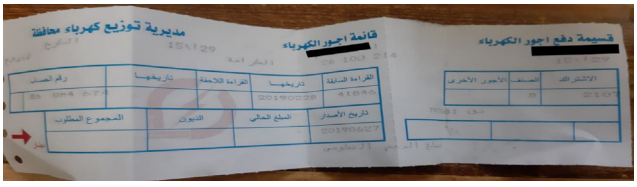

Photo 1 – Utility bill (Baghdad – Karkh)
[Source: Author's archive]

Installation of a new energy metering system at all levels to trace the flow of electricity through the system using automatic/smart metering and centralized monitoring tools is central to combating the causes of commercial losses including pilferage by hooking, bypassing meters, defective meters, errors in meter reading

10. CPCS (2015), "Development of Reform Road Map for the Electricity Distribution Sector in Iraq", The World Bank Group, Washington D.C, February.

11. The MOE estimated the unmetered customers are over 412,617 in 2017, which do not include an estimate of illegal connections or connections with old or faulty meters. Although it is difficult to estimate accurately, but of 98,224,641 MWh generated in 2017, only 40,758,608 MWh were sold. The majority of the existing end-user meters, around 80 percent, are more than 30 – 40 years old and some of them have never been recalibrated for accuracy purposes.

12. In early 2020, the MoE announced unexpectedly hiring thousands of unemployed youth. Many irregularities, briberies, and nepotism were involved in the employment process driving public criticism and outrage as the Ministry failed to pay their wages for several month (Source: Link)

and in estimating un-metered supply of energy and tampering. Thus, we recommend the government to initiate a program to upgrade customer meter installation as an important step towards 24/7 supply of electricity to all customers in Iraq. This will enable timely and accurate billing and will help residential customers control the amount of electricity they use and thus have better control over their bills. This in turn will lead to improved cash-flow, releasing valuable additional resources for investment in other initiatives. The Ministry needs a long-term plan to replace the energy meters with an AMR/smart metering system. The World bank estimates that such a metering program should consist of the installation of 2 million meters, representing approximately 50 percent of the customer population over an initial five-year period to replace a significant number of the old and faulty meters[13]. The metering implementation program should be targeted in areas where the percentage of the population receiving electricity is at its highest and also where losses are at the highest. This will ensure the maximum rate of return on investment. The MoE should give the consumers the choice to select the type of energy meter that suits its household income and limit the amount of electricity consumed. Consumption limiting meters could be suitable for low-income users to set aside an allocated amount of energy for each household with a fixed amount of electricity. The main benefit that can be derived from consumption limiting meter is its fairness to all subsidized households in getting an equal share of electricity and having more control over their bills, as their tariffs reflect their actual consumption.

Prepayment Electricity Meters are an alternative method of helping customers manage their spending on utility services (Photo 2). The households would buy a token or a card in advance, which they insert into the meter at home. The value of the token or card determines how much electricity can be used.

Photo 2 - Prepaid electricity meter (Courtesy of Landis+Gyr)

An alternative approach would be to install devices that physically limit the amount of service that the household obtains. Load limiters restrict the number of appliances that can be used simultaneously.

4. Energy Efficiency, Subsidy and Tariff Reform

It is widely believed that electricity subsidy is one of the important variables that hinders the effectiveness of energy efficiency schemes in the Middle East[14]. In Iraq, the government subsidy, which exceeds US$ 2.4 billion per annum, can be identified as a key variable which affects the strength of energy efficiency measures and its use (Table 1)[15].

Category	Actual Electricity Sold (US$)[16]	Electricity Cost without Subsidy (US$)	Amount of Subsidy (US$)	Percentage of Subsidy (%)
Residential	324,607,595	2,435,705,532	2,111,097,937	86.7%
Commercial	175,876,902	228,011,238	52,134,336	22.9%
Industrial	251,565,778	452,060,217	200,494,438	44.4%
Public	525,647,783	553,150,418	27,502,636	5.0%
Agricultural	29,242,580	52,907,507	23,664,927	44.7%
TOTAL	1,306,940,638	3,721,834,911	2,414,894,273	

Table 1 – Sold Electricity and Government Subsidy (2018) [Data Source: MoE, 2019]

13. Ministry of Electricity, Development of a Reform Roadmap for the Electricity Distribution Sector in Iraq (Baghdad: MoE, 2015. Authored by CPCS).
14. The World Bank Group (2016), "Delivering Energy Efficiency in the Middle East and North Africa Achieving Energy Efficiency Potential in the Industry, Services and Residential Sectors", May (Link)
15. Iraq was ranked 12 among the world top 25 countries in 2019 for value of electricity subsidies (US$ 1.27 billion) according to the International Energy Agency (Source: IEA (Link)).
16. The amounts are depicted in US Dollars for clarity (1 US$ = 1,200 IQD).

The low electricity price has discouraged any energy efficiency initiative and has had an adverse effect to inefficient usage of electricity. There is no motivation on the part of the consumer for saving energy as long as the electricity tariff remains low. There have been several attempts by the government in the past to raise the extremely low (or near free) electricity tariffs but resulted in serious public unrest[17]. The electricity subsidies will continue to constitute a significant burden on the federal budget (Figure 7) while the budget deficit is expected to amount to more than US$46 billion during 2020.

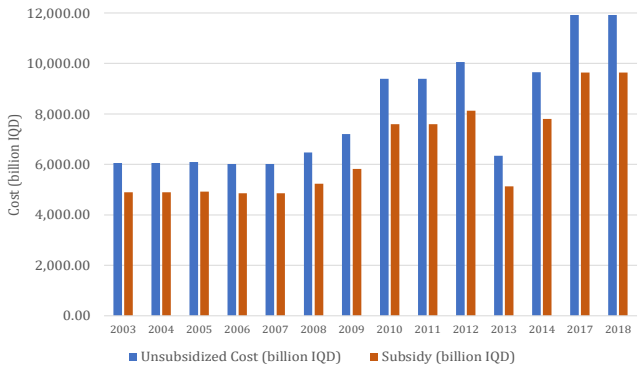

Figure 7 – Unsubsidized costs and subsidies (2003 – 2018) [Data Source: MoE}

Affordability for paying the electricity bill relative to household income should also be taken into consideration when evaluating the significance of phasing out subsidies, especially for low-income households. The universal benchmark set by many governments and international financial institutions for affordability is 10 – 15 percent of household expenditures[18]. Table 2 depicts the distribution of a household's average monthly income to expenditures for the Iraqi provinces (except KRI and four provinces affected by the war against ISIS). It is evident that incomes in provinces such as Muthana, Diyala, and Dhi'Qar are 45 percent less than Baghdad despite the electricity tariff rate being the same for all provinces.

Province	Population	Average Income per Family (thousand IQD)	Average Expenditure per Family (thousand IQD) *
Baghdad	8,126,755	2,107.7	612.7
Karbala	1,218,732	1,683.3	371.7
Wasit	1,378,723	1,614.1	327.9
Maysan	1,112,673	1,608.3	317.6
Najaf	1,471,592	1,557.4	384.3
Basra	2,908,491	1,459.5	368.9
Babel	2,065,042	1,382.3	319.6
Qadisiya	1,291,048	1,335.8	248.9
Dhi'Qar	2,095,172	1,186.8	274.4
Diyala	1,637,226	1,174.7	257.2
Muthana	814,371	1,136.2	237.5
Ninawah	3,729,998	§	§
Kirkuk	1,597,876	§	§
Anbar	1,771,656	§	§
Salahudin	1,595,235	§	§

* including accommodation, water, LPG, electricity, and other fuels.
§ no data available.

Table 2 - Average monthly income and expenditures of families (2014)[19] [data Source: Ministry of Planning]

17. Many Iraqis view the electricity supply issue as mismanaged, and view the government incapable of providing electricity continuously especially during summer when the peak demand is highest. Therefore, any financial plight arising from tariffs is wholly the government's fault. This sentiment towards the electricity service appears to be the result of frustration with unreliable supply and perceptions of poor governance. Despite struggling to afford electricity, many citizens are willing to pay higher prices, provided service quality improves. However, many are skeptical that such improvements will take place or be sustained. In such cases, people will likely have very low tolerance for tariff increases. Furthermore, the issue of electricity pilferage needs to be resolved as there are more than 500,000 illegal consumers who are enabled by collusion with utility officers. Thus, it is expected that the public would be against any large increases in the tariff rate or any reform that requires a real or perceived sacrifice on their part (Istepanian, 2020).
18. Samuel Fankhauser and Sladjana Tepic (2005), Can poor consumers pay for energy and water? An affordability analysis for transition countries, EBRD Working Paper, https://www.ebrd.com/downloads/research/economics/workingpapers/wp0092.pdf
19. Except Ninawa, Kirkuk, Anbar and Salahuddin provinces (data not available due to security reasons). The expenditures include accommodation, water, LPG and electricity bills.

For the poorest 7.35 percent of households, affordability equivalent to about 5 percent of income is "reasonable", while for the richest, 15 percent is more "achievable". This situation arises because of the high electricity consumption of residential users in hot localities, including low-income users, and the large subsidies they receive per-kWh. For example, the estimated average annual electricity consumed per household in Basra is 28,057 kWh compared to 14,267 kWh in Baghdad despite the average income per family in Basra being 44.5 percent less than Baghdad. Putting this observation into perspective, the large volumes of consumption among the low-middle income users in tariff zones (1 – 1,500 kWh per month) strongly reflects demand response to very low electricity prices. Low prices elevate consumption at all income levels and raise systemwide costs. If prices were to increase, residential users would find ways to reduce their electricity consumption.

Family Income (thousands IQD)	Percentage	Affordability (IQD per month)
< 500	7.35%	<25,000
500 – 1,000	23.3%	50,000 – 100,000
1,000 – 2,000	40.4%	100,000 – 200,000
> 2,000	28.9%	> 300,000

Table 3 – Electricity Affordability [Source: Iraq Energy, 2020]

To offset price increases, efforts are needed to improve efficiency on both the supply and demand side. Having an energy-efficiency program targeting mainly poor provinces will ensure affordable electricity for low-income households. The current structure of tariffs is not particularly equitable from a family income distributional perspective and is not particularly helpful when it comes to increasing tariffs for the entire country. The tariff structure would be designed to cater for the household income targeting mainly poorer families. The first consumption bracket from 1 to 1,500 kWh per-month is expected to cover the average electricity consumption of low-middle class households living in dwellings of 50 – 150 sqm, with essential electrical appliances plus one air-conditioning unit or evaporator cooler plus ceiling fans. The tariff rates on these consumption blocks are expected to be subsidized by larger consumers. A higher tariff rates should be designed to cater to the middle - high-class using basic appliances, plus 1 – 2 split air conditioners 1.5 ton (4,960 Btu per hour) cooling capacity and one evaporative cooler during summer days and hot water cylinder during winter days, while an unsubsidized tariff should be designed for the high-class consumers.

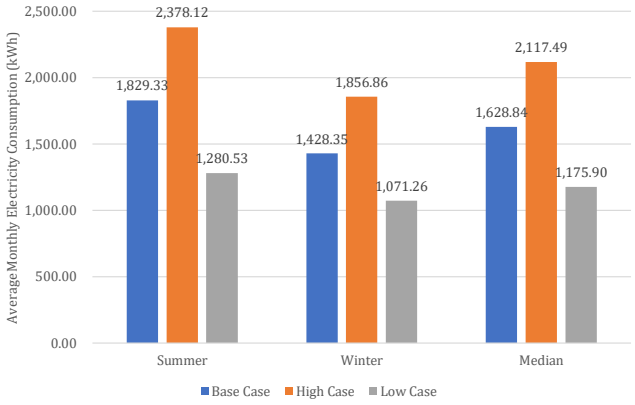

Figure 8 - Average monthly electricity consumption for middle-high income households [Data Source: Iraq Energy, 2020, Author's analysis]

Average Iraqi family spending on electricity is high if we count the total payment to the distribution companies (كهرباء الوطنية) and neighborhood private generators (المولدات الخاصة). The average payment to neighborhood generator costs is around IQD 10,000 (US$ 8.40) per 1 Amp per month (8 hours per-day) or IQD 120,000 (US$ 100) per-6 Amps for the entire day. Despite the intentions and the reasons for the tariff review, the concern is not only the changes in pricing and the magnitude of subsidies but also their distributional incidence since:

- More than 87 percent of the consumers are benefiting from low tariffs (IQD 10 and IQD 35), while the average poverty rate is 22.9 percent (39.3 percent living

in rural areas and 16.1 percent in urban areas) who are living under IQD 75,000 (US$ 65) a month[20].

The electricity subsidies delivered through the current tariff system are dominated by reducing the weighted average tariff rate from IQD 48 per-kWh to IQD 32.5 per-kWh to keep the electricity expenditures for the poor low.

5. Energy Efficiency, Climate Change and Health

It is widely believed amongst the scientific community that global warming is due to the gases produced by human activities[21]. Iraq is known of burning fossil fuels which has contributed?? significantly to atmospheric pollution, resulting in a wide range of damage both to the environment and public health especially in the southern oil-rich provinces[22]. The increase in the electricity production has come with substantial environmental challenges[23]. The World Bank estimates Iraq's annual discharge of carbon dioxide has increased from 84,540,890 tons in 2000 to 162,646,160 tons in 2016 from fossil fuels (Figure 9). The IEA estimates Iraq's energy sector is contributing directly to the environmental challenge, including the gas flaring which alone releases an estimated 30 million tons of carbon-dioxide (CO2) emissions into the atmosphere[24]. In Baghdad, the levels of fine particulate matter are more than seven-times the maximum recommended levels established by WHO standards[25]. A study of air quality found that gasoline and diesel engines mainly from the neighborhood generators account for over half of carbonaceous aerosols[26]. This provides an additional incentive to pursue a clean, more efficient grid-based supply such as renewable energy, which might constitute an important aspect of Iraq's energy strategy in the future to reduce the high dependence on the fossil fuel and subsequently the carbon emissions.

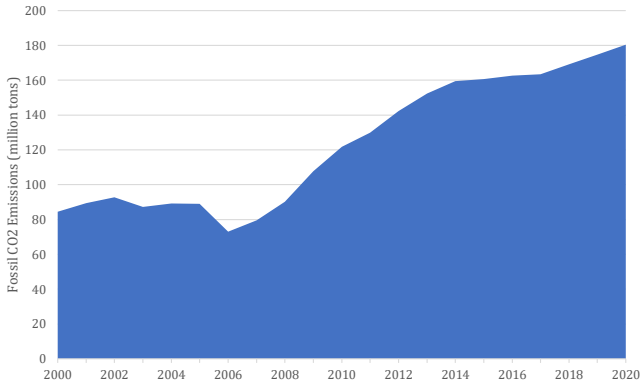

Figure 9 – Fossil CO2 Emissions (million tons) [Data Source: World Bank, Author's forecast]

Fossil fuel power plants and flared gas from the oil fields are not the only sources of pollution in Iraq, industrial facilities, particularly those consuming fossil fuels, emit significant amounts of air pollutants as well (Photo 3). Emissions from large-scale facilities, such as cement, fertilizer, sugar, and steel—many of which use furnace oil that is high in sulfur content—are a major contributor to CO2 emissions. A wide range of small scale to medium-scale industries, including brick kilns,

20. http://www.fao.org/fileadmin/templates/cfs/Docs1112/CFS39Docs/SpecialSession/CFS_39_Special_Session_Iraq.pdf
21. The Royal Society (2010), "Climate Change – Evidence and Causes" http://dels.nas.edu/resources/static-assets/exec-office-other/climate-change-full.pdf
22. According to a study conducted in 2011, the concentration of gaseous in Basra were: CO = 4.0 - 18.0 mg/L, CO2 = 230.0 - 280.0 mg/L, SO2 = 0.4 - 0.9 mg/L, NO2 = 0.5 - 1.3 mg/L (Source: Hassan W.F et al. (2016), "Monitoring of Air quality in Shaibah in Basra city/Iraq", The First of International Conference on Dust, 2-4 March, Shahid Chamran University, Ahvaz, Iran).
23. Almost 90 percent of Iraq generation of electricity in 2019 was using traditional energy sources including crude oil, HFO and natural gas.
24. IEA (2019), "Iraq's Energy Sector: A Roadmap to a Brighter Future". April (https://webstore.iea.org/iraqs-energy-sector). Gas flaring encompasses burning of unwanted gases associated with extraction of crude oil. Gas flaring is a significant source of greenhouse gases emissions.
25. ibid.
26. ibid.

steel re-rolling, steel recycling, and plastic molding, also contribute substantially to urban air pollution through their use of "waste" fuels, including old tires, paper, wood, domestic and textile waste. Industrial emissions are further exacerbated by the widespread use of small diesel and neighborhood electric generators in commercial and residential areas in response to electricity outages.

Photo 3 - A brick factory in Nahrawan, Diyala, Mar. 8, 2012 (Source: Reuters)

6. Iraq Housing Sector

The residential sector in Iraq is facing several challenges including an acute housing shortage, poor planning and design, lack of basic services, and unaffordability especially among low income groups. Many families are no longer able to afford decent housing for their members, forcing home owners to subdivide their properties to accommodate the increasing demand for housing. In most cases, informal subdividing of properties ignored proper design for amenities and basic services, resulting in substandard and cluttered buildings. The estimated housing shortage in Iraq is around 3 million units, mostly in urban areas[27]. The housing capital stock continues to decline as a result of an undercapitalized housing sector dominated by unclear government policy. Few private sector developers are interested to serve lower-middle income groups and sparsely populated areas. Besides, successive years of sanctions and wars have resulted in anomalous procedures for improving or redeveloping urban areas especially in the main cities of Baghdad and Basra[28].

6.1 Energy Use in residential buildings

Use of insulation material is not mandatory in Iraq and is hardly used. Achieving thermal comfort for Iraqi houses is a challenge due to Iraq's dry climate characterized by long, hot, dry summers and short and cold winters. Energy consumption of Iraqi houses depends heavily on its design, construction material, geographical location and orientation[29]. The construction materials of modern houses in Iraq are mainly bricks and hollow concrete blocks. Reinforced concrete is used for ceilings and ceramic tiles for flooring. Window frames are mainly made from steel or Aluminum alloys with large glazed areas.

27. The National Housing Policy identifies 200,000 dwellings is required per year for the next ten years or about one dwelling every 45 seconds of the working day.

28. Several housing projects were announced in past by federal and local governments for the provision of affordable housing. Most of them such as Basmaya housing complex were either canceled or failed to accomplish the expected goals and targets. To-date, the National Housing Policy developed in 2010 is also not properly implemented. Besides, housing shortage, population growth, rural-urban migration, rapid urbanization, the gap between supply and demand and lack of proper policies and laws also make the provision of housing ineffective.

29. For the sake of thermal comfort and energy efficiency, local architects mainly consider the fenestration for different orientations using a set of guidelines for the design of the windows in respect of the harsh summer sun. For example, the most vulnerable facades to direct solar gains are the east and west facades with the lowest areas of windows.

Photo 4 – Typical Iraqi houses in middle-high income neighborhood

Electricity is considered the prime source of energy for households in Iraq. Split type or widow mounted air conditioners are used for cooling. Fans and evaporative coolers are more common in low-mid income houses[30]. Kerosene heaters are dominantly used during winters due to lack of electricity supply (Figure 10). Domestic solar water heater (SWH) is seldom used in Iraq despite it could be a major contributor to the future energy supply. The solar radiation that Iraq's receives is between 2,800 to 3,000 hours per year with over 6.5 - 7 kWh/m² horizontal irradiation per day[31]. SWH is widely used in MENA region. For example, in west bank where almost 70 percent of houses and apartments have such systems, SWH is manufactured locally with a production rate of about 24,000 units per year which is considered to be sufficient for the local market[32].

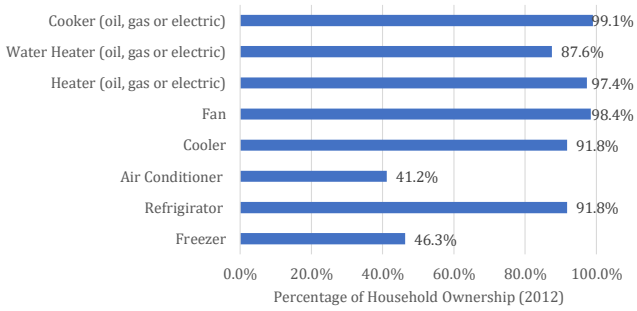

Figure 10 – Median Household Appliances Ownership in Iraq [Data Source: Ministry of Planning, 2013]

The detail of typical wattages of electrical appliances used in Iraq is given in Table 4.

Appliance	Watts
Split Air Conditioner (3 Star) 2.0 Ton, 6044 Cooling Capacity	1938
Window Air Conditioner (Central) 1.5 Ton, 4900 Cooling	1676
Evaporator cooler	700
Ceiling Fan	65
Lighting Single bulb	60
Refrigerator – Freezer Frost Free (20 cu. Ft.)	650
Water Heater – Typical Family of 5	3800

Table 4 – Typical Power Usage for household appliances [Data Source: Iraq Energy, 2020]

The average monthly consumption for a medium income household for summer and winter months ranges on average between 1,400 – 1,900 kWh per connection per month (Table 5)[33].

30. Air-conditioners and evaporative coolers are normally used to cool one space or two at maximum while central HVACs are generally uncommon in Iraqi houses. According to Iraq Ministry of Planning in 2012, almost half urban households in Iraq own air-conditioners, while more than 90 percent own evaporative coolers and fans.

31. Istepanian H. (2018), "Solar Energy in Iraq from Outset to Offset", Iraq Energy Institute, October 18, (https://iraqenergy.org/2018/10/18/solar-energy-in-iraq-from-outset-to-offset/)

32. Yamin M.Z. (2020), "Renewable Energy in Palestine", EcoMENA, February 23, https://www.ecomena.org/renewables-palestine/

33. The monthly electricity consumption is calculated based on each connection using basic appliances such as refrigerators, washing machines, TVs, irons, lightings and one split type air conditioner and air evaporator (مبردة) during summer months as well as a hot water cylinder (سخان كهربائي) and electrical heater (مدفأه كهربائية) during winter months.

Electricity Consumption ((kWh/month	Base Case	High Case	Low Case
Summer	1,829.33	2,378.12	1,280.53
Winter	1,428.35	1,814.74	1,046.96
Median	1,628.84	2,096.43	1,163.75

Table 5 – Monthly electricity consumption for Mid-high income [Source: Iraq Energy, 2020]

The ratio of electricity charge to average household income represents 3.3 percent or less. This is significantly less than the 5 percent international benchmark for low-mid income countries[34].

Family In-[come [2014 Thousand) IQD per (month	Percentage of Popula-tion	Ratio of Electricity Monthly Bill to House-*hold Income
Less than 500	7.30%	3.3% <
1,000 – 500	23.30%	1.5% – 3.3%
2,000 – 1,000	40.45%	0.75% - 1.5%
Above 2,000	28.95%	0.75% >

* for average electricity consumption of 1,500 kWh per month and subsidized tariff IQD 10 per-kWh.

Table 6 – Family monthly income and electricity bill ratio [Source: Ministry of Planning, Author's analysis]

There is no strong causality between Iraqi households' income and electricity consumption despite a general perception that wealthier or high-income deciles have larger homes with more electricity-consuming appliances. But this does not mean that all the lowest-volume electricity consumers are low-income, or that all low-income residential consumers use less electricity. Consumption by low-income residential users can be higher than expected in some cases, because they use old and inefficient appliances, or use electricity for home-based businesses, or multiple low-income residential users share a single electricity connection[35]. In addition, it is common for low-income residential users in hot summer areas of southern provinces such as Basra to consume more electricity than non-poor residential users in more temperate zones[36].

The houses located in southern Iraq, such as Basra, Maysan, Muthana, and Thi'Qar need more space cooling during summers whereas houses located in northern part of Iraq need more heating during winters. However, there are cities where both space heating and cooling are required due to the high seasonal variations and extreme ambient temperatures such as in Baghdad. Cooling appliances are the main cause of high electricity consumption especially during the extreme hot weather conditions, followed by water heating and refrigeration[37]. The amount of energy used for lighting, cooking or electronic items such as TVs is comparatively low (Figure 11).

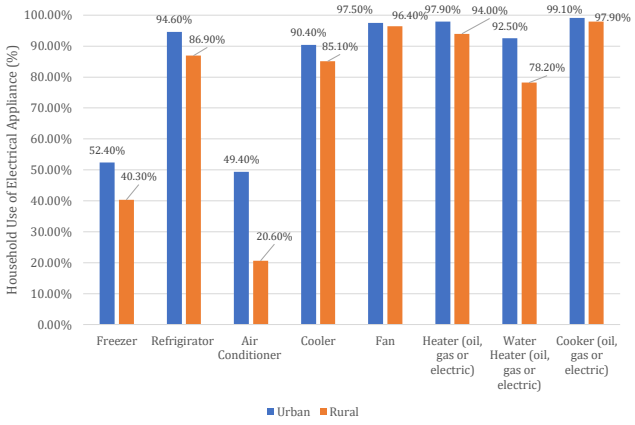

Figure 11 – Percentage of Iraqi households use of electrical appliances (2012) [Source: Ministry of Planning]

34. Masami Kojima and Chris Trimble (2016), Making Power Affordable for Africa and Viable for Its Utilities, World Bank Publication.
35. According to a survey by the Ministry of Planning in 2014, 86.6 percent of Iraqi urban families live in one housing unit, 13.4 percent of two or more families share one housing unit.
36. The climatic temperature variations of different regions in Iraq range from 7 to 20 o C in winter and 30 o to 50 o C or more in summer.
37. Iraq has imported more than 400,000 air-conditioners for domestic use in 2018.

Lighting is responsible for nearly 34 percent of residential electricity consumption in the Middle East[38]. The majority of the residential consumers in Iraq are still using incandescent light bulbs with few fluorescent light bulbs. Therefore, the options for applying energy efficient technology in the domestic sector should include the use of high- efficient lighting such as compact fluorescent light bulbs (CFL) and LEDs. Most households in Iraq are still using incandescent light bulbs. The compact fluorescent light bulbs could achieve energy saving up to 80 percent as compared to incandescent light bulbs. However, both CFL and LED are very expensive and low-income users are not aware of the advantages of such light bulbs. It is projected that energy saving measures can help to reduce electricity consumption in residential sector up to 27 percent by 2030. The effectiveness of this will depend on the goods import regulations as most of the appliances are not locally made. Our calculations show that a widespread use of LEDs could save about 2.45 TWh (Base Case) compared to incandescent light bulbs, which are widely used in Iraq (Table 7). This is the equivalent annual electrical output of 280 megawatts of baseload operation of a power station, and a total savings of more than 182 billion dinars ($152 million) in base case and could reach up to 257 billion dinars depending on number of light bulbs used by each household and number of hours[39].

Number of Legal Residential Customers [2018]	-	3,633,932	
Annual Electricity Sold to Residential Consumers (Subsidized)	million IQD	389,529	($324,607,595)
Annual Cost of Sold Electricity to Residential Consumers (Unsubsidized)	million IQD	2,922,847	($2,435,705,532)
Annual Amount of Government Subsidy	million IQD	2,533,318	($2,111,097,937)
Percentage of Subsidy	%	86.7%	
Annual Net sold Electricity [2018]	MWh	39,153,418	
Cost of Unsubsidized Electricity sold to Residential Consumers [2018]	IQD/ kWh	74.65	
Number of Light Bulbs Per Household	-	6	
Average Incandescent Light Bulb Wattage	W	60	

		Base Case	(High Case (+30%	(Low Case (-30%
Hours per day	h	6	7.8	4.2
Total Annual Lighting Consumption Per Household	kWh	777.6	1010.88	544.32
Total Annual Lighting Consumption for All Households	MWh	2,825,745.5	3,673,469.2	1,978,021.9
Percentage of Incandescent Lighting Consumption	%	7.22%	9.38%	5.05%
LED/ Incandescent Watts Ratio		0.13	0.13	0.13
Total Annual Lighting Consumption for All Households (6 LED Lights x 7.5 Watt)	MWh	376,766.1	489,795.9	263,736.2
Annual Energy savings Using LED Lights	MWh	2,448,979	3,183,673	1,714,285
Annual Cost of Sold Electricity to Residential Consumers for using Incandescent light bulbs	IQD	210,945,077,703	274,228,601,013	147,661,554,392
Annual Cost of Sold Electricity to Residential Consumers by using LED Lights	IQD	28,126,010,360	36,563,813,468	19,688,207,252
Annual Cost Saving for Using LED Lights	**IQD**	**182,819,067,342**	**237,664,787,545**	**127,973,347,140**
	$US	**(152,349,223)**	**(198,053,990)**	**(106,644,456)**

Table 7 – Annual Cost Saving using LED lighting bulbs

38. Abdel Gelil, Ibrahim (2014) "*History of Climate Change Negotiations and the Arab Countries: t*he Case for Egypt" Beirut: Issam Fares Institute for Public Policy and International Affairs, American University of Beirut).
39. The calculations are based on data provided by the Ministry of Electricity (2019). The calculations do not include illegal users. The MOE estimated the number to exceed 412,617 in 2017.

6.2 Green buildings

Iraq does not have a building code for the design, construction and safety for the newly developed and existing buildings. In the eighties of the last century, an Iraqi code was suggested by the Ministry of Planning but it was never adopted. Energy efficiency in Iraq remains voluntary to implement and a luxury rather than obligatory compared to some other countries in the GCC and MENA region. In the UAE for example, the government has taken a range of building efficiency measures such as Estidama (أستدامة)[40] program in Abu Dhabi for regulating the design, construction, and operation of buildings through phased approvals[41]. The program uses an assessment scale called the "Pearl Rating System" which measures the sustainability performance of houses, high-rise buildings, and gated communities. In Dubai, the government has issued a set of green building regulations and specifications that cover planning, the use of resources, materials, and waste[42]. Notably, the regulations are intended to improve the sustainability performance of buildings throughout their entire life cycles, from design through construction, operation, and ultimate tear-down. Iraq needs to learn from other countries' experience to develop regulations and frameworks that dictate energy efficiency in buildings and use a range of levers for licensing contractors based on energy performance; mandating procurement procedures that factor in total life-cycle cost, rather than just initial building permit; and requiring plans for energy consumption footprint prior to construction, as part of grating the building permit.

Jordan, the western neighboring country of Iraq, has adopted a National Energy Efficiency Action Plan (NEEAP) in 2013[43], the Plan includes EE applications in housing sector, such as installing 30,000 Solar Water Heaters with a targeted minimum saving of 147 GWH (≈1.6%) in addition to 5,162 Solar Water Heaters (SWHs), which have been distributed in cooperation with the Jordan River Foundation. Another example is to enhance the photovoltaic rooftop systems for electricity generation at public and residential buildings. A new building code that forces the use of solar water heaters for any house with a minimum area of 150 square meters is developed but has not been fully enforced due to human and financial capacity challenges.

In our opinion, the main difficulty for implementation of green buildings in Iraq is the market transformation due to the high initial cost compared to traditional buildings. Even if the justification for reduction in operational cost, which is equivalent to the increase in initial cost and can be recouped after 4–5 years with a green build, it is still hard to convince people, especially low-middle income households, that the initial investment will be worthwhile for healthier working and living environments. There is great market potential for LEDs, energy star appliances, and home insulation. However, the Iraqi market is so distorted that in the past 15 years it has never developed in comparison to other countries in the region.

40. The Arabic word for "sustainability".

41. https://www.upc.gov.ae/en/upc-services-and-tools/services/estidama-services

42. Building efficiency — commonly referred to as "green" or "sustainable" construction — refers to structures that are designed and built with improved energy efficiency as a key design constraint. The concept aims to reduce the environmental impact of buildings and to improve the well-being of their occupants.

43. The national RE&EE policy were included in the energy sector strategy of 2007-2020, as well as in the Vision 2025, which comprises several promising measures to tackle both, the demand side (e.g. energy labels, lighting, reduction of energy consumption of public buildings by 10 percent, buildings code, development of minimum standards/ specifications for appliances) as well as the supply side (e.g. solar water heaters, PV, capacity building in wind energy and concentrating solar power, solar energy code). Furthermore, the NEEAP outlines several horizontal and cross-sectorial measures such as tax exemptions for energy efficient and renewable energy equipment, development of energy service companies, green lending program, university curricula. (Source: Ministry of Energy and Mineral Resources (2013), "National Energy Efficiency Action Plan", https://www.rcreee.org/sites/default/files/plans_neeap_jordan_2013_en.pdf.

Policy changes can create the market quickly. Such as the invention of a fund[44] that will take over the costs first and as soon as the change pays off, citizens pay back.

A separate issue is the skill of architects and engineers to implement green building. At this moment, green building is only offered as an elective at some recently built shopping malls, therefore not many Iraqi architects major in this field. There is clearly the need to provide further training related to green building within universities and in the construction industry.

7. Energy Efficiency Policy

The Ministry of Electricity is currently the only federal authority which is responsible for promoting energy efficiency and conservation. The Ministry's public domain contains guidelines and techniques for energy saving to help in reducing electricity consumption for households[45]. Iraq is trailing behind other MENA countries in energy conservation policies. According to the 2017 AFEX report[46], Iraq scored 24 percent, one notch above Libya in the ranking compared to other MENA countries (Figure 12).

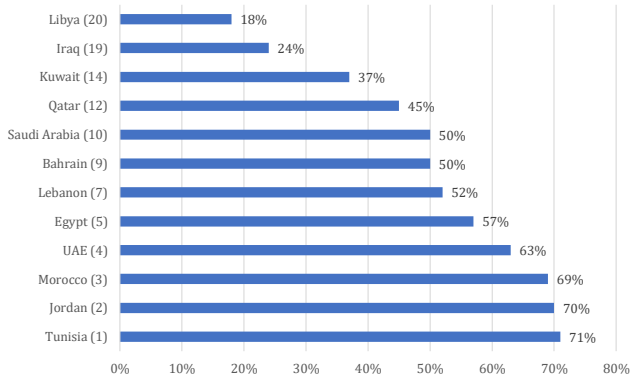

Figure 12-Energy Efficiency Progress for MENA countries (Data Source: RCREEE, 2017)

Since 2003, energy related laws and regulations have been subject to political disputes inside the parliament. For instance, the Hydrocarbon Law took several years to lay out the development of Iraq's oil sector[47]. Weak governance and mismanagement have been marring Iraq's energy sector for years, compounded by convoluted bureaucracy, red tape at multiple agencies, and corruption. According to the Institute of Regional and International Studies (IRIS) at the American University of Iraq in Sulaimani, Iraq could be losing up to $55 billion a year of potential revenue to mismanagement and waste, such as shortages of power supply and fuel, and untapped energy sources such as gas flaring[48].

In January 2010, Iraq and the EU signed a joint memorandum on the creation of a strategic energy partnership, part of which

44. Regionally, similar programs do exist and possess the same objectives. In Jordan, the Jordan Renewable Energy & Energy Efficiency Fund (JREEEF) has established a financing mechanism for all RE and EE measures, covering the private and public sectors. JREEEF projects are mainly aiming to maximize investment and create job opportunities which have an economic and social impact on the citizen and the country. In the domestic sector, the Fund for example has financed installation of 28,000 solar water heaters in houses with a subsidy of 50 percent, installation of 1,600 roof-top PV solar systems to generate electricity, and distribution of 200,000 "LED" lights in partnership with electricity distribution companies (Source: https://www.kuna.net.kw/ArticleDetails.aspx?id=2859955&language=en).
45. https://www.moelc.gov.iq/home/page/energy_conservation?lang=ar
46. AFEX uses over 30 indicators to rank Arab countries on progress made to achieve energy efficiency targets based on regulatory and institutional structures, financial innovations, policy frameworks and public and private investments (Source: RCREEE (2017), Arab Future Energy Index (AFEX 2017), Energy Efficiency)
47. Stanford Law School (2018), "Introduction to the Laws of Kurdistan, Iraq Working Paper Series Oil & Gas Law of Iraq", (https://law.stanford.edu/wp-content/uploads/2018/04/ILEI-Oil-and-Gas-Law.pdf)
48. Wahab, B. A. (2014), "Iraq and KRG Energy Policies: Actors, Challenges and Opportunities", Institute of Regional and International Studies (IRIS), The American University of Iraq-Sulaimani, May (https://auis.edu.krd/sites/default/files/WahabIRISReport.pdf)

was the commitment by the EU to aid Iraq in constructing a comprehensive energy policy[49]. The EU taskforce concluded that" "it is difficult to say where efficiency savings are needed most due to the erratically-functioning nature of much of the country's electrical power generation"[50]. Energy efficiency could play an essential role in tackling the power shortage if the government can take initial steps to develop a lucrative program by setting targets and standards for renewable energy and EE usage and minimization the dependence on fossil fuel through loan guarantees, "green" banks, and public funds. The EU/World Bank have joined forces for the implementation of EUR 12.9 million project in 2019 to support the Government of Iraq for modernizing the energy sector[51]. Among many other objectives, the project is aiming to identify key challenges in the electricity sector, that inhibit efficient service delivery and attraction of new investments especially from the private sector.

Unlike some other MENA countries, there are many success stories as well as lessons to be learned from the deployment of policy instruments to support the development of EE, which Iraq can benefit from in setting key policy for successful promotion of EE. The different types of EE policy instruments, their objective/ expected impacts, and some examples of policy instruments are summarized in Table 8.

Type of Policy Instruments	Objective/ Expected Impact of the Policy	Example Policy Instruments
Energy subsidization	Gradual reduce the government subsidy on fuel and electricity to make EE viable	• Means testing • Immediate remove of subsidy especially on high income households • Gradual remove of subsidy on low income households and replace with other social protection instruments
Commercial Incentives	To reduce EE project investment costs for EE technologies and activities to be more competitive and at par with conventional energy technologies and solutions.	• Soft loan • Green banks • Investment grant • Financial subsidy • Carbon CDM credit transaction
Fiscal incentives	To help improve the financial performance of EE appliances and make them more commercially attractive to facility owners and/ or investors.	• Accelerated depreciation • Tax exemption/ reduction

49. https://ec.europa.eu/commission/presscorner/detail/en/IP_10_29
50. International Business Publications (2011), "Iraq Energy Policy, Laws and Regulations Handbook", Washington, DC.
51. https://eeas.europa.eu/delegations/iraq/71490/support-energy-sector-reform-iraq_ko

Type of Policy Instruments	Objective/ Expected Impact of the Policy	Example Policy Instruments
Energy performance and management	Setting targets to reduce energy usage through certain percentage or absolute quantity of energy (especially for residential sector), and to mandate the minimum energy efficiency of electrical appliances.	• Energy performance targets • Energy management, audit and reporting • Electrical appliances standards and labeling • Forced retirement of low efficient appliances • Penalties for non-compliance to energy saving/ conservation obligations
Other EE policy measures	To support the capacity development of local stakeholders such as R&D institutions, academic institutions, consultant, equipment anufacturers, and service providers	• Financial and other support for R&D activities, knowledge development activities, • capacity building activities, local equipment • anufacturers and local service providers
Gender mainstreaming	To include the onsiderations, needs and priorities of both men and women in EE development and involve men and women in all EE policies and programs. Expected impact: gender-balanced involvement and optimal benefits for both men and women.	• Clearly stated goals, • quirements, guidelines, roles and resources allocation for gender • instreaming • Gender-sensitive targets and indicators for EE programs • Capacity building and training of women in EE technology • Loan programs for female EE trepreneurs

Table 8 - Types of EE policy instruments

8. Energy efficiency policies in MENA region

Although many countries in the region have witnessed an unprecedented wave of energy subsidy reforms, namely Bahrain, Egypt, Jordan, Tunisia, and the UAE have enacted policies to reduce electricity subsidies and increase fuel prices[52]. Many other countries including Iraq are still spending significant portions of their GDPs on providing subsidies for electricity and fuel well below the global average resulting in a financial burden for these countries. The low prices of energy have greatly affected the level of energy consumption of these countries leading to extremely high energy intensities

52. Abdullah Al-Badi & Imtenan AlMubarak (2019) Growing energy demand in the GCC countries, Arab Journal of Basic and Applied Sciences, 26:1, 488-496, DOI: 10.1080/25765299.2019.1687396

and electricity consumptions per capita. Furthermore, the high level of energy subsidies is greatly hindering any incentive at the consumer side to reduce energy consumption and invest in energy efficient technologies. Nonetheless, the recent drops in oil prices will encourage these countries, including Iraq, to undertake various reform actions and make progress in reducing their energy subsidies (Figure 13)[53].

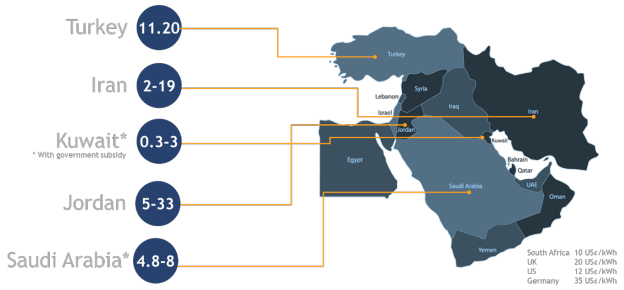

Figure 13 – Electricity Tariff in Middle East (US¢/kWh) [Data Source: World Bank]

Several countries in the region are witnessing some progress in implementing policies to phase out inefficient lighting for example by providing financial incentives for end users to switch to more efficient lighting, such as CFL or LED, or enacted bans on the sale of incandescent light bulbs[54]. The GCC states have adopted legislation and energy efficiency measures relating to appliances' energy standards and labeling namely for air conditioners, refrigerators and washing machines[55], but these standards and labels still lack adequate enforcement and diversification to include a wider range of appliances[56].

Jordan

Jordan has established a newly founded Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF). In 2016, Jordan increased its gasoline, diesel and kerosene prices, which is a vital step in encouraging a more efficient use of fuel, especially for a net oil importing country.

Tunisia

Tunisia's EE success hinges on effective EE planning and policy set forth in the country's long-term national energy strategy "Energy 2030 and its current New Program 2013 – 2020" that establishes regulatory framework, implementation strategies, and financial incentives to increase the deployment of EE measures and technologies.

Morocco

One of the key strengths in Morocco's EE measures are the reduction in energy subsidies and the maintenance of its strong electricity price structure. By liberalizing fuel prices, the government was able to reduce spending on energy subsidies by an estimated about US$ 840 million in 2016. Morocco's long-term energy strategy and energy efficiency goals (12% energy saving by 2020 and 15% saving by 2030) are supported by its US$ 1 billion Energy Development Fund (FDE). While Morocco's National Energy Strategy Horizon 2030 does set forth EE goals and establishes EE legislative framework, bylaws still need to be implemented for the success of planned EE initiatives.

UAE

Dubai has inaugurated Green Fund in 2017, an AED 100 billion credit line for EE and RE measures, provides vital funding for promoting and implementing EE projects. An increase in the regulation of energy consumption in the building sector and the provision of EE funding mechanisms has, in part, led to the UAE having the highest number of LEED certified buildings in the region and the 10th highest number in the world. The UAE's energy efficiency target is translated by both Abu Dhabi's Comprehensive Cooling Plan targeting a 15% energy demand reduction by 2020 from the base year of 2010, and Dubai's Integrated Energy Strategy targeting an energy demand reduction of 30% by 2030.

9. Barriers to Energy Efficiency Application

The general level of awareness on residential EE is quite low among the public due to various economic, technical, and institutional barriers,

53. https://www.iea.org/news/iea-commends-iraqs-plans-to-reform-its-electricity-sector
54. Abdel Gelil, Ibrahim (2014).
55. The World Bank Group (2016), "Delivering Energy Efficiency in the Middle East and North Africa Achieving Energy Efficiency Potential in the Industry, Services and Residential Sectors", May (http://documents.worldbank.org/curated/en/642001476342367832/pdf/109023-WP-P148222-PUBLIC-DeliveringEEinMENAMayEN.pdf)
56. RCREEE (2017), Arab Future Energy Index (AFEX 2017), Energy Efficiency, (https://www.rcreee.org/content/arab-future-energy-index-afex-2017-energy-efficiency)

which explain the low adoption of EE in Iraq.

9.1 Institutional and regulatory barriers

Institutional barriers refer to the awareness, behavior and capability of the households in energy saving and adoption of EE measures and their social and environmental benefits. As of today, Iraq does not have any Acts, Laws or Regulations that mandates the consumers to implement energy efficiency measures in residential, commercial or industrial sectors. These regulations and acts are vitally important to be legislated by the parliament in order to provide the legal basis for the government to implement any program in the future. However, the government needs to take positive steps to reform first the electricity tariff, until such time, the consumers will have no incentive or are not coerced to implement any energy efficiency measures. One of the key steps for the government to take is to establish an Independent Commission for Energy Efficiency (الهيئة المستقلة لكفاءة الطاقة) with a mandate to undertake or facilitate EE policies and regulations and be able to coordinate with other federal government's ministries and local governments which should be responsible for implementation of the policies. Such coordination is crucial to achieve the objectives in placing a robust monitoring and evaluation mechanism to monitor the progress of an EE program and gauge the level of enforcement of EE implementation.

9.2 Financial barriers

Financial barriers to adoption of EE technologies and practices in the residential sector of Iraq include: a) the high investment cost and long payback period of an EE program; b) lack of access to capital for investing in EE technologies; c) different priorities for capital investment (households often have limited capital available for investment, so they usually give priority for investment in other family expenses); d) limited financial incentives for EE government programs; e) cost associated with using EE electrical appliances. With the current economic crisis, inadequate public funds and little access to financing of an EE program are one of the main barriers to wide implementation of EE. Yet, regardless of economic and financial situation, Iraq needs to find multiple approaches that combine public and private financing, as well as through funds from international donors to match the EE needs of the consumers. The implementation mechanisms for deploying EE will also, to some extent dictate the financing mechanism best suited for an end-use sector—for instance, while utility-driven EE programs can leverage the ability of utilities to finance programs through increasing the tariff for a segment of consumers, while a program targeting low-income households may need a different approach. In the long run, as markets mature, private financing options are critical to create a sustainable market for EE services.

9.3 Technical barriers

Technical barriers include limited availability of EE products in the local market; and lack of technical details and energy consumption data of purchased appliances. In the absence of laws and regulations, there is limited awareness of the minimum energy performance requirements in Iraq, though only few home appliances are promulgated by labels, such as refrigerators and split air conditioners. Iraq does not have its own national certification for energy efficiency and lacks competent energy service companies that can offer services to customers who wish to contract out the management of their energy consumption.

10. Transition toward utilizing EE

Achieving EE goals for Iraq is not an easy task, it will take several years to be able to scale up the efforts to take a portfolio approach, establishing a robust environment that mitigates barriers and allows organizations involved in delivery to find efficient business models. At first, an EE program should be

accompanied with reviewing the current electricity tariff and energy subsidy. Any cut in subsidies will have more acceptability among the public if it is gradual in pace and clearly communicated to build ownership and trust with targeted groups. A gradual approach will facilitate a smoother socioeconomic transition to higher prices, provided the reform is backed by sound compensation mechanisms for low income deciles. The World Bank suggests that it will take Iraq around 5 years to gradually phase in tariff increases and ensure a successful reform57. As the current levels of electricity prices are very low compared to economic costs, one-off subsidy removal would necessitate very high price increases. However, there is no objective or "correct" transition period and the choice largely depends on considerations of political economy. A long transition period (exceeding five years) has a relatively smaller economic and distributional impact and is more politically palatable, but delays benefits and makes it difficult to sustain reform. A shorter transition period of five or less years, on the other hand, generates more rapid budget savings and ensures earlier establishment of the preconditions for longer term growth, but has a larger economic and social impact due to the higher annual price increases required and therefore, requires careful management. If the 5 – 10-year transitional reform of prices for all energy products were to be pursued, annual real price increases, on average, would range between approximately 13 - 85 percent. The effect of price increases on poorer households must have a special focus, as these households are likely to have limited opportunities for substitution and/or income enhancement.

Reforms are usually precipitated by macroeconomic needs or energy inefficiencies. Advantages can be taken from favorable conditions such as a low-price environment in order to minimize the adverse effect of the reform. Gradual sequencing can also distribute negative impacts over a longer time period and enable households to adjust, but it increases the risk that the reform may be abandoned due to changes in the political or budgetary situation. In general, the best practice is to start by providing support to the affected groups before or concurrently with the price hike. The pace of reform should take into account the time needed for the population to adjust to new prices and for compensation to come into effect58. Implementation capacity and development of delivery systems can be major bottleneck, and often determine the scale of reform and compensation. Social, political and fiscal factors play a role as well. The inequity of subsidy distribution will need a thorough review prior to proceeding with tariff reform to ensure the right social groups are targeted by any subsidy reduction in the future.

The core principle of transition of utilizing EE should include setting of a common vision toward environmental protection, emissions reduction, resource efficiency, security of supply and consumer protection. This might be achieved by focusing on cost of energy services (i.e., tariffs) and achieving consumer amenity (e.g., energy saving) through a common framework which we believe should include:

a. Change in government policy and setting EE as a priority to reduce the gap between the supply and demand for electricity;

b. Consumer and community attitudes through reforming the electricity tariff;

c. Development of laws and legislations;

57. The World Bank Group (2018), "Iraq Economic Monitor from War to Reconstruction and Economic Recovery, With a Special Focus on Energy Subsidy Reform", Spring (http://documents.worldbank.org/curated/en/771451524124058858/pdf/125406-WP-PUBLIC-P163016-Iraq-Economic-Monitor-text-Spring-2018-4-18-18web.pdf).

58. Sdralevich, C., Sab, R., Zouhar, Y. and Albertin, G. 2014. Subsidy reform in the Middle East and North Africa: Recent progress and challenges ahead. International Monetary Fund: Washington, DC.

d. Government and consumers' strong relationships;

e. Information flows and consumer education.

Such a robust framework will require substantial planning and resources - and more critically, political willingness to set targets and implement an EE program. The key elements of the framework would be common to all consumers' sectors, but each sector will have to develop its own roadmap suited to its consumers' conditions according to a national EE action plan. Ultimately, the goal of utilizing EE is to provide Iraq with the necessary knowledge and tools to integrate the various aspects of economic, social and environmental approaches in its transition toward an energy secure future and a better quality of life for the people of Iraq.

Iraq has been facing a severe power crisis since 2003 and is projected to surge in the long run. Efforts so far had been focusing on the supply side, while neglecting an equally important aspect of improving the energy efficiency on the demand side. The technical and commercial losses exceed 50 percent of the generated power. The majority of the losses are in the residential sector, which represents the highest energy consumer from the demand side. This report discusses the current status of energy efficiency in the residential sector of Iraq including policies and regulatory setup. The institutional, financial and technical barriers are discussed which could form an overarching basis to the core principle of transition towards a common vision of environmental protection, emissions reduction, resource efficiency, security of supply and consumer protection.

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