An Integrated Approach to Electricity Sector Reforms in the Resource Rich Economies of the MENA

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Abstract

This paper argues that MENA resource-rich economies must go beyond simply replicating the "standard model" of electricity market liberalization. They need to not only adapt the standard model to their unique contexts but also integrate it with other elements of their energy systems through harnessing complementarities between existing policies. The integrated model therefore includes additional modules: rationalising end user prices, improving energy efficiency, integrating renewables, and collapsing the "silos" between different energy vectors. The success of extended reform model, however, is crucially contingent upon taking into account three particular factors in its implementation. First, reforming energy prices requires a better understanding of the underpinning logic of subsidies beyond popular justifications around the "social contract" or "political compact". Second, energy efficiency is a challenging initiative in the MENA region, which the correction of price signals can only partially resolve, due to other factors that influence it, such as path dependency, market failures and consumer behaviour. And third, incentivising investments in

renewable energy requires careful design of the balance of roles between the market and government, as renewable support schemes may lead to an increased role for centralised coordination, thereby contradicting the originally intended objectives of electricity market reform.

Keywords: MENA; electricity reform; energy efficiency; tariff reform; renewables

1. Introduction

The last three decades have seen successive waves of electricity sector reform around the world. The first wave began in the late 1980s in the OECD countries, which pioneered what later came to be known as the "standard model" of electricity reform, and was followed by efforts to implement this model in non-OECD Asian and Latin American countries. Generally, the OECD model entails a set of measures including the corporatisation and commercialisation of national utilities, introduction of competition through unbundling, restructuring, privatisation and allowing for the entry of private power producers and distributors, the establishment of independent regulatory institutions, and the creation of competitive wholesale and retail electricity markets in which electricity prices are set based on marginal costs. International experience with market liberalisation based on the "standard model" has showed the role of local contexts in influencing the outcomes of reform, which the "standard model", by definition, excluded, and the literature is replete with evidence on the same, especially for non-OECD developing countries (Foster and Rana, 2019; Bacon, 2018, Lee and Usman, 2018, Rudnick and Velasquez, 2018). Apart from this, the "standard model" lacked an integrated approach to reform: for example, the design of the wholesale electricity market in pioneering countries such as the UK started to reveal its inadequacy with the growth of renewables. The "standard model" pre-dates the era of renewable energy

expansion (and of zero marginal cost renewables) and is considered to be unsuitable for renewable integration (Poudineh et al., 2018a). Additionally, the emergence of new objectives related to decarbonisation has highlighted the need for a systems-level approach to reform. A system approach, in this context, means looking across electricity, transport, heating and cooling and identifying services that determine energy use, and re-constructing the planning and operation of the energy system such that it produces less waste and emissions. For instance, over-generation caused by wind and solar power plants during some hours of the day can be used to produce hydrogen. The hydrogen then can be used to decarbonise the existing natural gas networks and also as a seasonal storage to address long term variations in wind and solar generation (Keay, 2018).

The waves of reform have largely bypassed the MENA countries, whose electricity sectors have historically been organized around vertically integrated, state-owned utilities endowed with a statutory or de facto monopoly over generation, transmission and distribution. In the late 1990s and early 2000s, legislation in MENA countries led to the slow beginnings of a transition away from this model, but progress has been lagging and reforms have continued to be based on the pre-renewable era "standard model". The reform laws of Iran (1999), Saudi Arabia (2005) and Algeria (2002) envision wholesale markets; the UAE's (Abu Dhabi) reform law (1998) envisages disaggregated single buyers with bilateral trading and third party access, whereas the reform laws of Kuwait (2008; 2010) and Qatar are limited to Independent Power Producers (IPPs) in generation, and unbundling (for Qatar) (Dyllick-Brenzinger and Finger, 2013). The electricity markets in the region are still variants of the single-buyer model with differences in the levels at which competition plays out. MENA governments own most of the generation assets in the region, all of its networks and pipelines, determine prices for various segments of the value chain, and remain the sole provider of feedstock to

power plants. They have also struggled to establish independent regulatory institutions, with current institutional frameworks for energy dominated by the oil and gas sector. Renewables in these countries must therefore compete with other energy vectors in an uneven playing field.

In addition to the sluggish pace of reform, there are three factors which pose constraints to achieving full results from electricity sector reform. First, retail energy tariffs have been highly subsidised and do not accurately reflect production or opportunity costs.[1] Dyllick-Brenzinger and Finger (2013) estimated that, before recent price reforms, in the high-income Gulf Cooperation Council (GCC) countries and Iran, residential tariffs for electricity ranged between less than 1 and 2 US cents/kWh, compared with between 6 and 18 US cents/kWh in the OECD countries.[2] The fall in oil prices in 2014 sparked a spate of attempts to retrench public spending and increase energy prices, particularly in the GCC countries, and although this effort seems to have persisted, the adjustments have mainly been made to either transport fuels (e.g. gasoline and diesel) or when extended to electricity the final prices remained significantly below costs of supply due to the very low base upon which adjustments are applied.[3] Over the last two years, some countries such as Saudi Arabia have seen upward increases in residential tariffs – for instance, data from the Saudi Electricity Company puts the average residential electricity tariffs for 2018 at 4.82 US Cents/kWh, which is still well below the actual cost of electricity supply in the country. In other countries such as Iran tariffs have remained significantly low given the generation mix (1 US Cent/kWh for

[1] That is export prices of fuels used for power generation.
[2] The comparison of end user electricity tariffs of MENA and non-MENA (OECD) countries may not be considered entirely accurate, because of a lack of data on the cost components of MENA tariffs, and the level of subsidies and technical/non-technical losses in its network segment. MENA end user tariffs also do not contain taxes/surcharges. This comparison is just for illustrative purposes in relation to what prices might look like when the market is liberalised.
[3] The UAE, Bahrain and Oman adopted formula-based price adjustments for transport fuels, whereas other GCC countries such as Saudi Arabia carried out ad-hoc increases (Moerenhout, 2019).

households as of March 2019). As a consequence of subsidized tariffs, utilities' revenues have been insufficient, requiring them to frequently fall back on national budgets for their investment requirements and operation. Despite the fact that since 2014, these countries have introduced unprecedented fiscal and price reforms (e.g. VAT was introduced in Saudi Arabia and the UAE in 2018), the persistence of energy subsidies, the increase in government spending, and volatile oil revenues, have effectively placed many of these countries on a fiscally unsustainable path.

Second, MENA countries have traditionally been performing poorly on energy efficiency and this trend is predicted to continue. According to the BP Energy Outlook (2019) while the average decline in global energy intensity by 2040 will be 37 per cent, energy intensity in the Middle East, which is already higher relative to other regions, will decline by a much lower 11 per cent – making it one of the most energy intensive regions of the world.[4] The prolonged existence of subsidies has led to severe distortions in consumption and affected the development paths of the transport sector, of infrastructure and the built environment across the MENA countries.[5]

Third, most MENA countries have introduced ambitious long-term renewable energy targets. For instance, Kuwait is targeting 15% of electricity demand to be met by renewables by 2030 and the UAE's target is 24% clean energy (including nuclear) in the energy mix by 2021. Saudi Arabia initially was targeting 9.5 gigawatts (GW) of solar capacity by 2023 but recently revised to 27.3 GW by 2024 and 58.7GW by 2030, while Iran is pursuing 5 GW of

[4] These energy intensity numbers compare current and projected energy intensity under a 'Business as Usual' scenario, which assumes that there are no external shocks (such as a significant fall in global oil prices) that cause a major change to the GDP of MENA countries.

[5] To illustrate, electricity consumption per capita in Kuwait, at 15,000 kilowatt-hours (kWh) is nearly double the average for high-income countries. Residential buildings account for the majority of electricity consumption and lack any mandatory building efficiency standards. Similarly, 80% of Kuwait's transport fleet is made up of private vehicles and public transportation is underdeveloped.

solar and wind capacity by 2020. MENA countries intend to meet their targets through a combination of Feed in Tariffs (FiTs) and net metering for small projects, and auctions for larger projects. However, if these targets are to be realised primarily through government support schemes without considering their market compatibility, the "standard model" of electricity reform, which is currently being pursued in the region, is likely to fail. This has been evidenced in many OECD countries which pioneered the "standard model" and that imposed renewables (via support schemes) on markets that have been designed for a pre-renewable era. Marginal-cost-based price formation in energy-only electricity markets[6] has little relevance for renewable generation technologies, which have zero marginal costs. The simultaneous operation of renewables and traditional generation within competitive wholesale markets has led to market breakdown and distortion of electricity price signals, especially when renewables receive out-of-market payments (Keay, 2016).

Therefore, any attempt to re-design reforms for the electricity sector in the region needs to consider the above context. Given that most resource-rich MENA countries are at an early stage of reform (that is, vertically integrated or single-buyer structures), this could constitute an advantage when designing new reform packages to fit with their unique circumstances.

This paper argues that MENA countries need to adopt an integrated approach to electricity sector reform. The integrated approach involves the adaptation of the "standard model" of reform to local contexts, as well as its extension to include additional modules in order to harness complementarities between existing energy policies; namely, rationalising end user prices, improving energy efficiency, including renewable integration as part of sector

[6] Energy-only electricity markets are the standard design of electricity markets where energy (kWh) and ancillary services are the only commodities that are traded (as opposed to electricity markets in which capacity (kW) is also traded). The price of electricity, at any period, is set based on the marginal cost of the most expensive power plant brought online to meet demand and the incentive for investment is built into the price spikes that are created by scarcity of supply.

reforms, and creating a level playing field for all energy vectors. This paper builds on arguments in Poudineh et al. (2018a) which addresses the adaptation of the standard model of reform to local MENA contexts. Our exposition is that, while the tailoring of reform models to local contexts is very important, reform also needs to be carried out in an integrated manner which includes all aspects of energy systems, and takes into account future changes in markets, technologies and policies. This is to minimize forward misalignments between the components of reforms and new policies, technologies and regulations. In this paper, we focus on the need for an extended reform model and the policy challenges in the implementation of an integrated approach.

The next section describes the "standard model" of reform, its deficiencies, and explains why MENA countries need to extend this model such that electricity reforms integrate with wider energy policies. Section 3 deals with the implementation challenges, and Section 4 concludes.

2. Developing an integrated approach to electricity sector reform

2.1 Review of the "standard model"

The economic rationale for electricity sector reform has its foundations in microeconomic theory and industrial organisation, in which a fundamental objective is the maximisation of social welfare through introduction of the competition. Standard microeconomic theory shows that welfare is maximised under perfect competition where prices are pushed down to marginal cost; in contrast, monopoly leads to a deadweight loss. Prior to the 'wave' of reforms that began in the OECD in the 1980s/90s, the industry was seen as best organised around conditions leading to increasing returns to scale and cost efficiencies to be realised by a monopoly market structure. As the number of consumers supplied by a utility increased, reserve margin requirements decreased because the grouping of heterogeneous consumers

effectively pooled the risk faced by the supplier, and as a consequent, operating and capital costs were expected to decrease (Steiner, 2000). Furthermore, duplicative fixed costs of production could be avoided (Armstrong and Sappington, 2006). Under private ownership, a profit-maximising monopolist could charge a price higher than marginal cost, resulting in deadweight losses and thus need to be regulated. In some places governments instituted public ownership under the assumption that state-owned companies would not maximise profits, thus leading to greater consumer welfare (Sen et al., 2016; Steiner, 2000).

Beyond the economic rationale to restructure the monopolistic electricity supply industry, electricity reforms have also been driven by technological advancements in the electricity industry. Advances in generation technology reduced the minimum efficient scale of operation, challenging the traditional large integrated utilities, and enabling the functional decomposition of the industry, which provided the initial momentum towards reform and the building blocks of the "standard model" which was pioneered in four OECD countries – the UK, Norway, Chile and the US. It was argued that replacing regulation with competition could increase operational and investment efficiencies with positive effects on output and economic activity (Newbery, 1996), and market liberalisation was seen as facilitating competition. Full privatisation was not seen as necessary to engendering competition, as competitive reform could be implemented under public ownership in some segments of electricity supply industry (e.g. Norway, where network companies belong to local municipalities). The removal of entry barriers to competitive segments (i.e., wholesale and retail electricity markets) was seen as particularly crucial to welfare-enhancing competition. The end goal of electricity sector reforms under the OECD model was therefore market liberalisation and the consequent efficiencies that it can bring to the industry.

The efficiency objectives of the OECD model (which evolved into the "standard model") of electricity reforms can be reduced to the following:

> ***Operational efficiency***; reflected in lower wholesale (and retail) electricity prices; and,
>
> ***Investment efficiency*;** wherein the incentives to encourage more investment in generation are built into the market price signals, rather than through externally imposed generation adequacy standards where the risk of overinvestment and underinvestment is transferred to consumers.

The "standard model" comprised the progressive restructuring of the electricity sector from a *vertically integrated monopoly* (VIM), which owned and operated generation, transmission, distribution, and retail supply, to full wholesale and retail competition, with each step resolving different issues in the functioning of the sector.[7] The first step from a VIM is a *bundled single-buyer model*, which allows for competition (private companies) in generation, but transforms the VIM into a monopsony—creating perverse incentives for the latter to prioritize its own generation assets in the dispatch. The *unbundled single-buyer model* corrects for this distortion, through the unbundling (accounting and/or ownership separation) of generation from transmission and distribution. However, the single buyer (undertaking transmission and possibly distribution, if integrated with transmission) may decide not to offtake power from generators, or may default on its payments. Hence, the *multiple-buyer model* allows for more than one offtaker (for example large electricity consumers, regional transmission companies, and distribution or retail companies) with grid operation carried out by an independent system operator, or by the largest transmission system operator. This model creates a wholesale electricity market for dispatch. The wholesale market is a marketplace in which generators compete for dispatch and provision of ancillary services.

[7] Poudineh et al. (2018b) provide a taxonomy.

Retail suppliers and large consumers can buy from this market. A hybrid market structure has also emerged in some Latin American countries where the wholesale market is complemented with a market for long-term contracts to ensure resource adequacy (Roques and Finon, 2017).

The fifth step allows for *full wholesale and retail competition* with wholesale market organized typically around day-ahead transactions, bilateral contracts and balancing (this is mainly the case in the EU region, but different jurisdictions have different market designs) and retail electricity market, organised mainly in the form of a posted-offer market. The wholesale market relies on market price signals to organize both short-term coordination for dispatching, and long-term coordination for investment in generation capacity (Roques and Finon, 2017; UKERC, 2010). In a retail market, suppliers can compete to provide electricity to end-users who are in theory free to switch between suppliers; however, the implementation of retail competition has turned out to be difficult, and retail prices are still partially regulated, even in many OECD countries. The standard model entails the regulation of the natural monopoly element of the electricity supply industry (i.e. transmission and distribution networks), which includes non-discriminatory third party access to the transmission and distribution networks.

2.2 Extending the "standard model" of electricity reforms: application to resource rich-MENA countries

Over time, major weaknesses have emerged around the "standard model". The standard electricity market design (based on an energy-only market) ignores market imperfections around short- versus long-term coordination (Roque and Finon, 2017). The interests of

market participants are not aligned, weakening their incentives to contract forward and share risk. This is partially because retail competition allows consumers to switch suppliers at short notice. Furthermore, even if this does not happen, in practice, it is difficult for retail companies to sign contracts with generators in the wholesale market that significantly exceed the duration of their contracts with customers (which is often one year). There is also no financial market for forward hedging. These imperfections increase the cost of capital for investors, potentially leading to an inadequate or suboptimal generation mix and frequent price volatility. The resulting issue of resource adequacy has led some of pioneering countries in market liberalisation to introduce significant interventions (i.e. capacity mechanisms) in their electricity markets.[8]

Shortcomings are not limited to wholesale market design; the entire package of reforms practiced in the OECD is under question. There is a growing consensus that the adoption of the OECD reform model by MENA countries with no regard to contextual heterogeneity could create further complexity.[9] For instance, the OECD model is said to have failed even in other non-OECD countries (e.g. in Asia) due to its replication without regard to the context and objectives in specific countries – while the original objectives of the OECD model were to achieve higher efficiency, lower consumer prices and consumer choice, in non-OECD countries the model was implemented to resolve the inadequacy of investment and remove the electricity supply constraint on growth (Williams and Ghanadan, 2006).

[8] For example, forward capacity auctions are in place in many US jurisdictions and were introduced in the UK in 2015. Centralised strategic reserve mechanisms have been approved and will be introduced in Germany and Belgium. The National Electricity Market of Australia is also considering enhancements to their existing strategic reserve mechanisms.

[9] Context is particularly important for MENA countries, as the adoption of more market-based approaches results in political challenges (for example if prices were to be based on marginal costs, this would require the removal of subsidies and would lead to much higher electricity prices), whereas moving towards a fully subsidized renewables programme (in addition to existing fossil fuel subsidies) increases fiscal and economic pressures, especially at times of low oil prices (Poudineh et al., 2018b).

Figure 1 encapsulates the five generic measures involved in the implementation of the OECD model ("standard model") of electricity reforms described above on the horizontal axis, with the associated originally-intended objectives (i.e. productive efficiency, disincentivizing anti-competitive behaviour, allocative efficiency, equilibrating supply with demand and aiding price formation, and, lower tariffs for consumers/greater consumer choice) on the vertical axis. It also emphasizes the sphere of influence of local contexts in MENA countries – comprising factors such as the existing structure of the power sector, role of government, technology, quality of institutions, and public acceptance – on determining the extent to which "standard reform model" measures can be successfully implemented.

[Figure 1 here]: The Standard Model– Objectives, Measures and the Role of Local Contexts

Source: Authors

The discussion above emphasises the need for MENA countries to adapt the standard model to fit their local contexts. This means re-designing of the whole package of reform including wholesale and retail markets as well as network regulation with a view to contextual heterogeneities in the region. For instance, Poudineh et al. (2018a) argue that MENA countries could adopt a hybrid wholesale market design of short-term coordination (through energy-only markets) combined with long-term contracts, whereas retail markets can be opened to competition for large consumers, but regulated for small users without the government distorting retail prices through subsidies. They also argue that for the network

segment, MENA countries can adopt a regulatory model that encourages innovation, as opposed to traditional incentive regulation with a sole focus on cost efficiency. [10]

In addition to this adaptation, we argue that there is a strong rationale for MENA countries to *extend* the original reform model by including the following additional modules as part of their electricity reform programmes: rationalising end user prices, improving energy efficiency, including renewable integration as part of electricity sector reform, and collapsing "silos" to create a level playing field for all energy vectors. We review each of these in turn.

Rationalising end-user prices: First, in order to achieve the desired outcomes from electricity reforms, MENA countries need to have an undistorted valuation of electricity, as clear price signals are necessary for attracting investment into the sector. The extent of price distortion among MENA countries is such that despite government incentives, private investments in generation capacity remain inadequately poor. Notwithstanding the aggressive price reforms, in recent years, in countries such as UAE and Saudi Arabia, residential prices in the region are still far below the world average (see Figure 2).

[Figure 2 here]: Residential electricity prices in selected MENA countries

Source of data: GlobalPetrolPrices.com (2019)

Camos et al. (2018) in a study of electricity utilities in 14 MENA countries find that in half of these countries, a quasi-fiscal deficit (QFD) exists that exceeds 4% of the entire economy's GDP. This deficit represents more than the average investment urgently needed in the region's electricity sector, estimated at 3% of GDP. In other words, the sector's investment

[10] Refer to Poudineh et al. (2018a) for a full exposition.

gap could be filled simply by removing the current level of QFD[11] through modifying tariffs. However, special attention needs to be paid to the effect of price reforms on the immediate welfare effects of liberalisation and consequently public acceptance. This is because liberalisation is welfare-enhancing, in the short run, only when prices are cost-reflective and there is overcapacity in the system, i.e. when average costs lie above marginal costs, as competition can drive down system average cost and potentially final prices (Kahn , 1979). When average costs are below marginal costs at the outset or when tariffs are heavily subsidised as in the MENA region, *rising* prices and hence worsening consumer welfare are a more likely early outcome of reforms towards competitive markets as pricing distortions are corrected. Nevertheless, competition is still welfare enhancing in the long run and adverse short term effects can be limited with direct lump sum transfers or payments to worse-off consumers (Armstrong and Sappington, 2006). A cost reflective electricity price sends an efficient signal to consumers as well as investors in the sector.

Improving energy efficiency: Second, without energy efficiency, the reform process would not deliver optimal results. According to the IEA (2018), primary energy demand in the Middle East has grown at 4.4% per year since 2000, a rate that is more than double the world average. Among other things, this has meant that two in every five new barrels of oil production have been consumed domestically during this time. Economies across the region are now among the most energy-intensive in the world—the UAE, the least intensive in the region, requires 10% more energy to generate a dollar of economic output than the world average. Saudi Arabia's electricity consumption has now reached the same level as that of Italy, despite having a population half its size and per-capita income that is 35% lower (IEA, 2018). These figures imply that any benefits from the restructuring of the electricity sector

[11] About two-thirds of the QFDs detected can be traced to tariffs set below cost-recovery levels, and the remaining third is explained by commercial losses, collection failures, and overstaffing.

carried out in isolation are likely to be countered by deeply entrenched patterns of wasteful energy consumption – and the two elements of the energy system (i.e. price rationalization and efficiency improvement) must be coupled for a meaningful outcome. Moreover, apart from the obvious environmental gains (e.g. water and energy savings) there are synergies with price rationalisation: raising fuel and electricity prices reduces the payback period for products with higher efficiency, and helps raise public awareness of the links between efficiency and the cost of the energy they consume (IEA, 2018). Although attempts are being made across the region to improve efficiency of electrical energy use, the potential benefits need to be viewed more specifically as complementary to policy on electricity sector reform.

Renewable integration as part of an extended electricity reform model: Third, renewable integration needs to be an integral part of the reform rather than an add-on to the restructured industry at a later stage. This is because marginal-cost-based price formation in energy-only markets has little relevance for renewable generation technologies which all have very low marginal costs (close to zero) (Keay, 2016). The simultaneous operation of renewables and traditional generation within competitive wholesale markets designed for thermal generation will lead to market breakdown and distortion of electricity price signals, if the market is not adapted to accommodate heterogeneous technologies. Poudineh et al. (2018b) identify and categorise various supporting measures that has been adopted at each stage of restructuring under the "standard model" to enable the integration of renewables (see Figure 3). However, many of these schemes face a trade-off between investment incentive and market compatibility. For example, a feed tariff is a highly effective means of incentivising investment in renewables however, it is not market compatible as it shields generators from market price signal and thus distorts their operation decisions. On the other hand, a feed in

premium is more market compatible but it exposes renewable generators to market price risks and thus is not an attractive scheme in the eyes of investors.

[Figure 3 here]: Models of market structure and range of renewable support schemes

Source: Poudineh et al. (2018b)

Moving away from a "silo"-based approach to reforms: Fourth, there is an emerging consensus that a "piecemeal" approach to addressing energy sector reform, and in particular, decarbonisation, can create conflicts and misalignments between various components of electricity markets and other parts of the energy system, resulting in significant unrealised efficiency and potentially derailing the reform agenda. In contrast, an *integrated energy systems approach* to electricity and decarbonisation policy is increasingly being advocated in many OECD countries (e.g. the UK) – where complementarities can be harnessed between different parts of an energy system. The integration of energy systems happens at least in three domains: physical (or infrastructural), institutional (market, regulation and policy) and at scale (or geographical). Physical integration includes integration not only across energy vectors, for example, combined heat and power (CHP) plants, but also across other sectors such as water, transport (for instance, connection of Electric Vehicles to electricity networks), and data and communications networks. An example of institutional integration is between the gas and electricity markets, when agents (for example generators or suppliers) in one market utilise information in the other market in their bidding behaviour. And finally, an example of integration across scales is the utilisation of demand response in the power system, which increases the market footprint with granularity all the way down to the

customer level. The interactions are driven by a desire to improve performance, increase efficiency and utilise flexibility provided by the entire energy system.

Although the four extended modules are theoretically compatible with electricity sector reform, MENA countries are likely to face certain additional challenges in implementing them. In the next section we highlight some of these challenges, and suggest new ways of thinking about how to address them.

3. Addressing challenges in the implementation of an integrated approach

3.1 Energy price rationalisation

Energy subsidies in the MENA's resource-rich countries have always been explained through citing an unwritten social contract, where governments extracted and managed their countries' hydrocarbon riches in return for citizens' participation in sharing resource rents – this relates to the concept of no taxation and no representation or alternatively, rent distribution in return for political support. This is believed to constitute an important part of the social contract or political compact between rulers and citizens/subjects in the region's oil economies (although in practice, the social contract has other dimensions as well, such as security) (El-Katiri and Fattouh, 2016; Hertog, 2017). This argument has also repeatedly been used to explain the difficulty of removing energy subsidies without introducing political reforms – which has subsequently stalled reforms in some countries (Eibl, 2017). While the argument based on social contract rightly points to the need for rent distribution, given the political structure in these countries, it tells us nothing about *why a particular form of rent distribution (subsiding a commodity in this case) should be preferred over others*. In fact, rent distribution can be of any form, from subsiding commodities or services to providing

insurance and cash payments. Social welfare theory tells us that any rent in excess of basic administration costs of the government should be distributed as lump sum grants and be used to finance essential services such as compulsory education, health or their equivalence (Newbery, 2016). The fact that MENA resource rich countries have chosen to subsidise energy carriers rather than following social welfare theory for rent distribution has to do more with their economic context, rather than their political context.

There are at least two economic reasons why resource rich countries subsidise commodities rather than following social welfare theory. The first is that these countries have limited capacity to invest resource rents locally and profitably without creating inflation or other adverse macroeconomic impacts. The second is that populations in these countries may not have confidence that a Sovereign Wealth Fund (SWF) would bring any benefit, not least because the discount rate that the public would apply to a SWF would exceed the likely return of these funds (because of uncertainty in future revenues and risk attitudes). A better understanding of the economic logic of subsidies would thus help to reduce or eliminate them in the future. First and foremost, the economic and regulatory infrastructures (including communications, transportation, and distribution networks, financial institutions and markets, and energy supply systems) in the MENA's hydrocarbon countries need to be better prepared for a transition away from commodity-based subsidies to other forms of rent distribution. Second, communication with the public and a mitigation strategy to shield (vulnerable) consumers against shocks are important elements of policy. Sound communication is needed to assure the public that the removal of energy subsidies implies only that the *form* of rent distribution changes (to the advantage of the public), but not the rent distribution itself. Mitigation measures such as cash payments are thus needed to reassure the public of

government commitment to rent distribution – many MENA countries are arguably already moving in this direction (e.g. Saudi Arabia's 'Citizen Account').[12]

3.2 Energy efficiency: the invisible fuel

The MENA resource rich economies are among the most energy intensive countries of the world although energy efficiency, as an 'invisible fuel', is often considered the cheapest way to curb unconstrained energy demand. In the electricity sector, the cost of saving one kilowatt-hour is a fraction of the cost of producing it, particularly when inefficiency is high. There are many factors that affect energy efficiency including energy prices, technology, information, consumer behaviour and path-dependency given the long life of energy consuming assets. However, among these various factors, analysts and policymakers often focus only on under-priced energy as the reason for exceptionally high energy intensity in the MENA region. While price is an important driver of energy demand and associated investment decisions, the effect of non-price factors is substantial when their overall effects are considered. This suggests that even if price distortions are eliminated there remains a significant amount of energy inefficiency in the MENA economies if non-price factors are not addressed. For example, path-dependency is an important factor. The region's current energy consumption is influenced by investment decisions that have been made in the past. The characteristics of the existing built environment in the region, the fleet of transport alternatives, population, and the pattern of human settlement are all fixed factors that affect energy demand but cannot be changed solely through rationalising end-user prices. These imply that there is some form of "structural energy inefficiency" in the MENA economies

[12] Such non-market measures to deal with rent distribution can implicitly also deal with affordability, which is not guaranteed by the market. Prices can be made rational for all consumers, and cash transfers can be used to ensure affordability of electricity to specific households (e.g. low income).

that a price signal cannot easily eliminate.[13] This problem is unique to resource rich countries, in that their economies have developed around cheap and abundant fossil fuels (and also cheap labour).

There are two other problems relating to energy efficiency that are relevant in every context. These are behavioural barriers and market/organisational failures. Behavioural barriers are related to hidden costs and attitude towards risk. Investment in energy efficient appliances are often costlier and riskier (due to uncertainty in the payback period) and these may cause people to forego such an option. Moreover, the cost of energy, even after removing subsidies, is a tiny fraction of households' expenditure in resource rich countries, which hardly creates any economic incentives for behavioural change. Market and organisational failures are related to lack of information, information asymmetry and incentives. Few programmes exist in the region to create consumer awareness around high energy consumption levels or mandate energy efficiency labels on appliances and energy performance certificates for homes. Even in places where such programmes exist, their uptake has been sluggish or inconsistent. There are also issues related to the misalignment of incentives for energy efficiency investment, such as those between landlords and tenants, or between governments and its departments. Therefore, while energy efficiency is much needed in the MENA's resource rich countries, its realisation is one of the most onerous tasks for its governments. Analysts often highlight the challenges of removing subsidies in the

[13] An example of structural energy inefficiency can be seen in Saudi Arabia. In 2015, the government raised electricity tariffs for all users apart from households with levels of electricity consumption of less than 4000 kWh/month, which were considered low consuming users and thus shielded from price increase. In contrast, in the UK, the average *yearly* consumption of electricity for a typical household has been around 3300 kWh and gas around 16500 kWh (Ofgem, 2011). This implies that electricity consumption of a low consuming household in Saudi Arabia was more than double the combined electricity and gas consumption of an average household in the UK. As we argue, such a massive difference partly comes from structural energy inefficiency that a price signal cannot remove on its own. In 2018, the Saudi government increased electricity prices for "low consumption" brackets by 260 per cent to SAR 0.18/kWh ($0.048/kWh).

region but correcting the price signal is just the first step for promoting energy efficiency and much remains to be done to promote energy efficiency even after all energy prices are fully rationalised.

MENA countries can embed energy efficiency initiatives and incentives into their power sector reform. For example as the electricity sector liberalises and retail companies are created (whether independent from distribution networks or combined with them) the government can choose to include energy efficiency obligations in the licenses of these companies, to enforce energy efficiency measures more widely among residential consumers.[14] These companies then can recover the costs of their energy efficiency measures from retail tariffs in a competitive or regulated retail market.

3.3 Alternative energy sources

The issue of renewable investment in the MENA resource-rich economies has been the subject of various studies in recent years (see Newbery 2016) however, little attention has been given to the key questions of why renewable investment is needed in these countries and how the incentives for investment need to be provided. The need for renewable investment in resource-rich countries has been previously justified in terms of dealing with increasing energy demand, compliance with climate agreements and exploiting the positive externalities of the renewable sector (i.e., job creation and economic diversification, among others). While these arguments are valid, there is also a supply side argument that at least equally important. Figure 4 presents the generation mix in MENA resource rich countries by the type of fuel. As seen from the figure, these countries rely entirely on natural gas, oil products, and oil for power generation – these three fuels constitute almost 100% of the generation mix.

[14] In the UK, energy efficiency is part of Energy Company Obligations that applies to retail suppliers of a certain threshold, which participate in the market.

[Figure 4 here]: Generation mix in hydrocarbon economies of MENA by type of fuel (2014)

Source: IEA Energy Balance

The share of other resources such renewables and nuclear in total power generation is almost nil. Natural gas is the only fuel that is used by all MENA countries for electricity generation. However, in recent years the demand for gas in many of these countries has surpassed exploration and utilisation of new gas reserves. Figure 5 presents gas consumption versus net trade for the main countries of the region. As seen from the figure, Kuwait and UAE are already net importers whereas Saudi Arabia has zero net trade and Iran is marginally a net exporter. Only Algeria and Qatar have significant production surpluses. This means that if the increase in electricity demand (which is forecasted to grow significantly over the next 20 years)[15] is not met with additional gas power plants, it unavoidably will be met with oil and/or oil products fired plants which have extremely high opportunity costs for these countries. Moreover, in countries such as Algeria where the government is dependent on gas export revenues, the growth of domestic gas consumption for power generation is becoming a concern (Aissaoui, 2016).

On top of that is the issue of long-term fiscal sustainability due to uncertainty about long-term oil demand. The topic of peak oil demand has received much attention in recent years and there are contradictory estimations about its occurrence and time frame.[16] We do not know if and/or when there is going to be peak oil demand because it is an uncertain

[15] Across the Middle East, for example, a 5.7% per year increase in electricity demand has translated to a doubling in the region's oil consumption for power generation over the last 20 years (IEA, 2018).
[16] For example, Wood Mackenzie, the consultancy firm, recently estimated a peak oil demand around 2035 while the International Energy Agency sees no peak oil demand on the horizon.

phenomenon. However, one thing is certain: renewable investment will benefit the oil-dependent countries of the MENA whether or not peak oil demand occurs. The argument is as follows: if oil demand peaks in the near future, the optimum strategy for these countries is to maximise their oil export revenues in short to medium term before the demand for oil is affected. Alternatively, if it became evident that there was no peak oil demand in the foreseeable future, renewable investment maximises their long-term revenues from hydrocarbon exports (given their rising domestic energy demand). Therefore, all in all, investment in renewable energy is a "no regret" strategy for the resource-rich countries of the MENA as it can help alleviate the pressure on domestic oil and/or gas consumption and thus boost their export revenues.

[Figure 5 here]: Gas consumption and net trade in MENA resource rich countries (2014)

Source: IEA Energy Balance

A challenge facing the governments of the region is how to best incentivise renewable energy, given their economic context. Overall, investors can be incentivised through two polar ways (Figure 6). One approach would be to remove fossil fuel subsidies and internalise the cost of externalities. This creates strong incentives for renewable investors to enter the power market specifically as their costs are falling. Renewables are at an inflection point and are now globally competitive on a plant-level basis (excluding intermittency costs). Recent solar auctions in the MENA have demonstrated that solar PV is among the cheapest options in the region. In 2019, the International Renewable Energy Agency (IRENA) estimated that solar PV costs in the GCC had declined to less than $0.3/kWh, leaving behind natural gas,

LNG, coal, oil and nuclear. In Saudi Arabia and Oman, wind has emerged as another cost-effective option.[17]

The second method is to subsidise renewables to the level that they can compete with under-priced fossil fuels. However, these two polar solutions (full renewable subsidies and full internalisation of externalities to raise the price of fossil fuels) cannot be implemented in their pure forms in the region. This is because the complete removal of fossil fuel subsidies, in the short run, will face significant public resistance and is likely to have adverse macroeconomic effects such as recession and inflation. At the same time, a complete renewable subsidy programme, in addition to the existing fossil fuel subsidies, is very costly to the public budget, especially in a low oil price environment. Therefore, the most practical way to create incentives for renewable investment, at least in the short to medium term, is through partial energy price reform and partial government subsidy programme (a "combinatorial" approach). This balances the fiscal pressure on government budget against political acceptability. It is also compatible with the energy price reform plans currently underway in the region in which governments are gradually and partially rationalising the price of all energy vectors.

The other benefit of a combinatorial approach is that it provides a clear exit strategy for governments of the region. As the cost of renewables declines and as the MENA governments gradually and progressively raise final tariffs to make them cost-reflective, the share of the public budget required to support renewables will decline. Over time, there will be a point at which no further government support will be needed and thus the market fully takes over. This reduces the risk of renewable support schemes as a counteracting force to

[17] The four bids submitted for the 400 MW Dumat Al Jandal wind project were reported to be between 2.13 US cents/kWh and 3.39 US cents/kWh.

one of key objectives of liberalisation: that is, limiting the role of the government and increasing the role of the market, where possible.

[Figure 6 here]: Policy instrument spectrum for incentivising renewable investment

Source: Poudineh et al. (2018b)

3.4 Rethinking the "silo-based" approach to MENA energy policy

Resource-rich MENA countries need to devise a sector level strategy and abandon the old mentality of placing electricity, gas, oil and renewable into separate silos. The traditional silo approach was suited to a time when the end market for these resources could be separated. Currently and for the foreseeable future, gas, electricity and oil compete for various services such as heating/cooling and transport in the end-users' market. Therefore, a comprehensive energy sector strategy in which all energy sources are treated in an integrated (and perhaps equal basis) is needed more than ever.

The cross vector integration facilitates competition between electricity and other fuels for the services that have traditionally been provided by carbon intensive fossil fuels. Beyond the infrastructure integration, there is a need for a higher degree of coordination across regulatory and organisational aspects of the energy sector. In MENA countries, the regulation of different energy vectors is separated by applying different sets of rules based on different principles. This is a barrier to utilising the synergy across the energy system. The energy markets and regulations in the region must be designed and coordinated in a way that leads to the optimal operation of the entire energy system. Such a strategy demonstrates the

government's commitment for support of all energy sources including renewables, and sends the signal of policy stability. It also allows the realisation of not only a more sustainable growth path, but also improved productivity and industrial diversification in oil-based economies.

The governments of the region also need to consider energy and climate policies together; a point which becomes increasingly relevant following the Paris Climate Agreement, with decarbonisation becoming the focal point of many countries' energy policies. Such a view can also be justified from an economic perspective because climate policies (the introduction of renewables, carbon tax, emission performance standards and energy efficiency measures) not only affect the relative use and price of alternative energy sources but also the shape of the energy demand curve and inter-fuel competition.[18] This implies that the separation of climate and energy policies can lead to unintended consequences in energy markets which then may require further policies to remedy. Finally, if public resources are to be used to give one form of energy source an advantage over another (through a subsidy, for example) this needs to be done in an optimal way, because from a societal perspective there are harmful and less harmful subsidies. There is little doubt that fossil fuel subsidies are harmful for society, not least because they incentivise wasteful consumption and have adverse impacts on the environment. The question is: can we say the same about subsidising household owned solar PV? Probably not. There are likely to be more advantages (e.g. positive externalities) to society from subsidising solar PVs than subsidising fossil fuels. Given this and also the need for rent distribution in the resource rich MENA economies, governments need to rethink their

[18] Matar et al (2017) for instance explore the impact upon energy demand of various alternative policies to induce a transition to a more efficient energy system in Saudi Arabia, including the deregulation of fuel prices, and introducing investment credits or feed-in tariffs for efficient fuels. They find that the alternative policies result in nuclear and renewable technologies becoming cost-effective and producing 70% per cent of the kingdom's electricity in 2032 in contrast with hydrocarbons at present, and reducing the consumption of oil and natural gas by up to 2 mb/d of oil equivalent.

energy policy to align it with wider societal benefits and longer term objectives of sustainable growth.

4. Conclusions and policy implications

The main contention of this article is that the MENA's resource-rich economies need not just adapt generic models of electricity sector reform to their unique contexts, but in order to avoid the failures experienced in OECD countries, they also need to extend these models and include new 'modules' in their reform effort to harness complementarity with existing energy policies. An integrated energy sector reform thus includes the following modules: energy price reforms, investment in energy efficiency, investment in alternative energy and collapsing silos between different energy vectors.

However, the inclusion of these modules in addition to the standard model increases the complexity of reforms significantly and MENA policymakers need to consider carefully the specific challenges related to the implementation of the integrated approach to electricity sector reforms. First, successful energy price reform and elimination of fossil fuel subsidies requires an understanding of the logic of subsidies which goes beyond the often simplified explanation of politics and the "social contract" – we argue that the economic context matters a great deal. Second, energy efficiency is one of the biggest challenges facing the region, and the correction of price signals (which has been the focus of efforts in this area) can only partially resolve it due to other factors such as path dependency, market failure and elements of consumer behaviour, which need to be given due attention. Third, investment in alternative energy requires giving a careful consideration to the balance of market and government roles in providing investment incentives for renewables, as an unintended consequence of support strategies could end up being greater centralised coordination, which is in direct contradiction

with the objectives of electricity reforms. Finally, the traditional view of energy strategy where electricity, oil products and gas are placed into separate silos does not work anymore, as the end market for these energy carriers can no longer be separated.

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