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The Electricity Distribution Industry in Germany and South Africa – A Review of Policy and Regulation



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The Electricity Distribution Industry in Germany and South Africa – A Review of Policy and Regulation

A Discussion Paper

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Introduction and Background



South Africa

South Africa's electricity sector is amid a multifaceted transformation. Energy security concerns, rising electricity prices, the emergence of renewable energy technologies and the introduction of independent power producers are some of the key reasons. In light of these dynamics, energy utilities and municipalities are compelled to re-define their role in the electricity value chain and adapt their funding and operating models.

Municipal entities play a strong role in South African electricity distribution and supply. Around 180 municipalities as well as the national utility Eskom are active in the distribution and supply of electricity. The distribution business is increasingly facing economic and technical problems. This is due to highly fragmented retail markets, aging infrastructure, underfinanced municipalities, regulatory uncertainty and sometimes difficulties in governance and institutional effectiveness. Many municipal utilities are also exposed to the challenges of growing urbanization, electricity theft, poverty and tariff cross-subsidization.

For the past ten years, South Africa's electricity distribution industry has experienced the delinking of economic growth and electricity demand growth. Sales of electricity in the Metropolitan municipalities have shown a sustained downward trend over the last years and have in some cases dropped significantly. Today, the sale of electricity is below 2007 levels amongst all metropolitan municipalities. This development is accompanied by increases in average effective electricity tariffs for the metropolitan municipalities by more than 100%, following sharp increases in the Eskom electricity wholesale prices. On the consumer/ municipal customer side this development has led to a greater interest in energy efficiency as well as interest in self-generating electricity for own use from technologies such as solar PV. This trend accounts for all types of energy consumers including industrial, commercial and residential customers, which has led to overall lower municipal electricity sales.



Germany

Municipal utilities also play a dominant role in the German electricity market. Traditionally, more than 900 German “Stadtwerke” are active in the energy generation, supply and distribution fields. The pluralistic structure of the German energy industry and the existence of different types of energy companies (publicly owned and privately-owned) have been pivotal in creating competitive and innovative energy markets that are the backbone of the German economy in many areas. Beyond this, the existence of municipal energy utilities has also played a major role in raising local awareness and participation towards fair and sustainable energy generation and consumption. The decentralized and pluralistic structure of the German energy industry is one of the major reasons for the German energy transition, the “Energiewende”, with a high degree of local participation.

With its 180 municipal energy entities, the South African energy market possesses a similar pluralistic structure and, therefore, the potential to further explore and benefit from municipally-steered electricity distribution and supply.

Energy Partnership



Energy Partnership
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South Africa - Deutschland

The South African-German Energy Partnership (EP), created in 2013 under the leadership of the German Federal Ministry for Economic Affairs and Energy (BMWi) and the South African Department of Energy (DoE), identified the topic of municipal utilities to be of high importance and considers reliable distribution networks as essential for economic growth, job creation and poverty reduction. Given the massive potential for de-centralized PV-based production of electricity that is mostly fed into the local distribution grid, a strong and reliable structure of local energy utilities seems almost indispensable for a robust and sustainable development of the South African energy markets. Hence the question, how and to what extent can the know-how and experiences of German municipal utilities be helpful for the South African context? Are there common problems and solutions in both countries? What is the international experience around the restructuring of energy markets and energy transition? Are new business models, especially regarding the switch from commodity supply to provision of energy services, an approach that South African utilities could follow?

Energy Market Design and Municipal Utility Business Models Workshop

In previous workshops that were held under the South African-German Energy Partnership, South African municipalities as well as policy stakeholders expressed great interest in learning more about the German model of municipal utilities. The Energy Partnership was willing to respond to this request and organized a one-week policy discussion workshop on energy market design and municipal utility business models, dedicated to South African officials, at GIZ head offices in Eschborn/Germany, from 4-8 December 2017.

The objective of the workshop was to discuss and compare trends in the South African and German electricity distribution industry and to identify and address key issues faced by municipal utilities. The workshop drew from international experience in electricity market design and combined policy discussion elements with training and capacity building elements. The workshop investigated new institutional and business models for the distribution of electricity at the city level. It took into account future

dynamics in supply and demand and learning from leading examples of this transition internationally.

Topics that were covered by the workshop included a brief history on the process of liberalization of the European electricity markets, mechanisms to finance and operate the distribution grid, municipal business processes for electricity trade and supply, the impact of distributed generation on grid tariffs, as well as emerging municipal business models. Furthermore, the main pillars of municipal utility revenue collection (wheeling fees/ grid charges, energy supply and trading, generation business, energy services/ efficiency and energy management) were discussed.

The workshop was organised on behalf of the Secretariat of the South African-German Energy Partnership (EP) and the South African-German Energy Programme (SAGEN) by a consortium of consultancy firms, consisting of Eclareon, Becker Büttner Held (BBH), Becker Büttner



At GIZ head offices in Eschborn/Germany for a policy discussion workshop on energy market design and municipal utility business models.

Held Consulting (BBHC) and Sustainable Energy Africa (SEA). In total, 22 South African delegates from national government including state-owned enterprises (SOE's), line agencies, associations, science as well as from municipalities participated in the workshop.

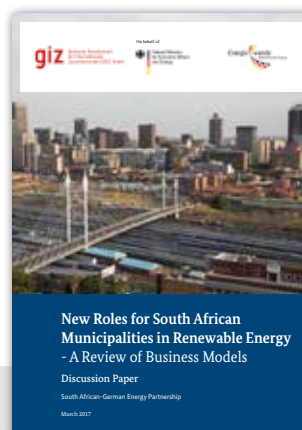
This paper focusses on the discussions and outcomes that emanated from this workshop. It shall provide additional input into the South African debate on Energy Market Design and Municipal Utility Business Models. It builds on previous publications of the South African-German Energy Partnership:



GIZ (2017): New Business Models for Municipalities in the Electricity and Energy Sector - German Approaches

Available online under:

www.cityenergy.org.za/uploads/resource__406.pdf



GIZ (2017): New Roles for South African Municipalities in Renewable Energy - A Review of Business Models. Discussion Paper

Available online under:

www.cityenergy.org.za/uploads/resource__429.pdf



Content of the Discussion



A German and a South African participant of the policy discussion workshop following a presentation.

This discussion paper tries to provide a closer look into the fundamental elements that characterize the German and South African energy markets, respectively. Sequel to the latter, the paper highlights the challenges that are prevalent in the energy markets of both countries together with the opportunities that can be exploited in the current structures of these energy markets. This is followed by an action list that was produced and discussed by the participants of the one-week policy discussion workshop on energy market design and municipal utility business models at GIZ head offices in December 2017.

I. The German Power Market: Liberalisation and Energy Transition

1. Liberalisation of the Energy Market

The first fundamental change in the German energy market was triggered by the liberalisation process starting in the mid 90-ies. The major goal of the EU backed liberalisation of energy markets in Europe was to create efficiency gains through the establishment of competitive market behaviour in energy trade, supply, and generation. The concept of liberalisation is based on the opening of the grid infrastructure (as natural monopoly) to all relevant market participants. Allowing other market participants to access and use the grid under non-discriminatory conditions, should provide for competitive trade and supply markets, incentivize innovation and efficiency. It should also create a market environment that favours competitiveness and innovation over stable but inefficient conditions.

The 1998 Energy White Paper in South Africa established the basis for sector reform with the goal of achieving a more efficient, equitable and sustainable (financial and environmental) sector. However, contestation over the reform has meant that the South African energy market has not been fully liberalized yet.

In Europe, in turn, liberalization and unbundling have altered the structure of energy markets in a fundamental way.

The following points serve to understand the process of liberalisation:

- The energy markets under monopoly structures worked as closed and stable systems that provided investment security but did not allow for new players to enter the market and did not provide incentives for efficiency or innovation. Concession contracts for grid operation were awarded exclusively to the vertically integrated companies. These integrated companies were at the same time active as grid operators, trader/supplier, and generator. All market participants were bound by long-term supply contracts. The energy sector was exempted from the application of competition and cartel law.
- The rupture introduced by unbundling totally changes the system by allowing competition in the areas of generation and trade/supply. Key for this is unbundling of grid operation and trade/supply and the introduction of regulated third-party grid access. Unbundling of transmission grid operators had to

be conducted more thoroughly than unbundling of distribution grid operators. Competition and anti-trust law is applied to energy market participants (especially long-term supply contracts were held to be illegal).

- The structure of an unbundled energy market and the different market roles in such a market have to be set up by the legislator and the regulator has to ensure abidance with these rules. This requires the separation of virtual trade and physical transport (in a full-fledged market with balancing system) and distinction between grid access and grid use.

The clear regulation of third-party access is of major importance for the creation of competition in liberalized energy markets. In Germany, the development moved from negotiated party access (which proved as non-functioning) to an entry-exit-based model of regulated third-party access. This type of third party access nowadays exists in all energy markets of EU Member States.

In connection with the unbundling process of the German Stadtwerke, a special rule becomes relevant. According to Art. 26 (4) of the Electricity Directive (Directive 2009/72/EC), EU Member States could decide to exempt distribution grid operators with less than 100,000 customers from strict unbundling. This so-called de-minimis-exemption was applied by most Member States and also by Germany. However, every production grid operator has to carry out unbundling of accounts and ensure data confidentiality. The majority of Stadtwerke carries out grid operation via a separate branch within the same company.

Since the establishment of liberalisation, the traditional business branches of a German Stadtwerke can be distinguished according to the regime under which they are carried out:

Table 1: Non-regulated and regulated businesses of German Stadtwerke

Non-regulated/ competitive markets	Regulated
Trade and supply of energy	
	Operation of grids (natural monopoly)
Electricity generation	
Other energy services	

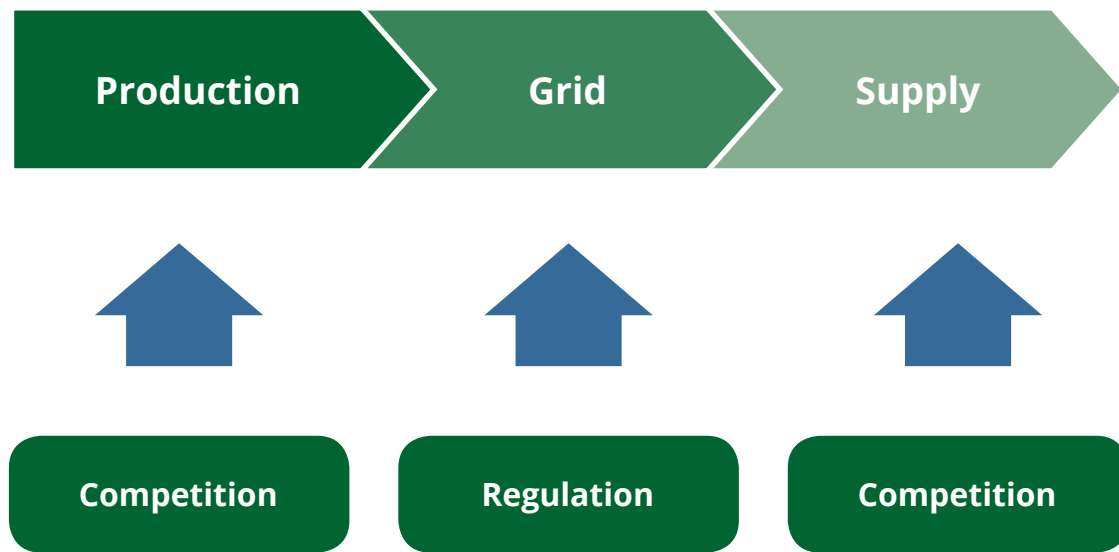


Figure 1: The unbundling process, grid operation & supply process of the German Stadtwerke

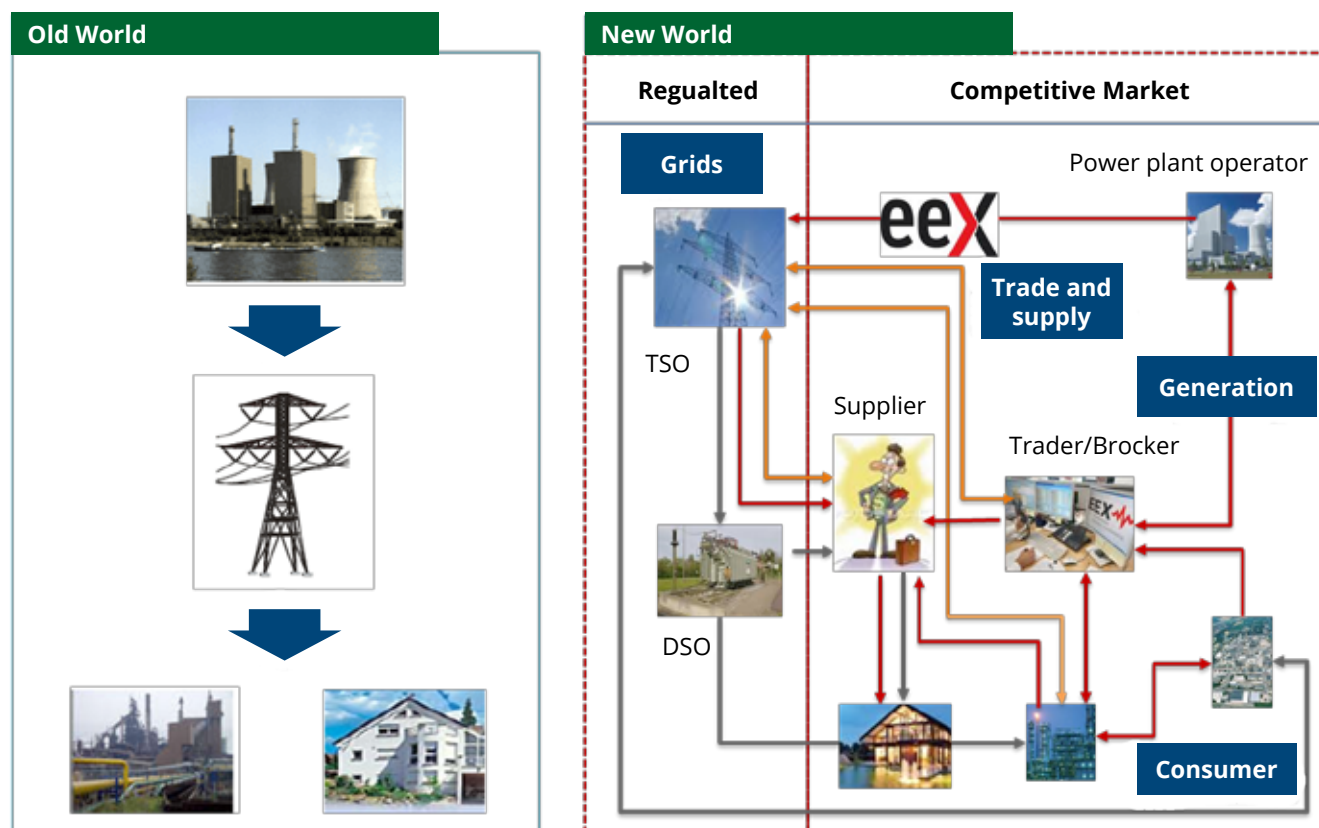


Figure 2: Regulated and competitive markets in the new world (after liberalisation) as opposed to the old world (before liberalisation)

The figure above describes the regulated and competitive market structure after the liberalization process.

The fundamental distinction between regulated activities on the basis of a natural monopoly and un-regulated activities on the basis of competition requires a strong and functioning regulator. In Germany, there is the Federal Network Agency (BNetzA) and several State Network Agencies (Landesregulierungsbehörden). The latter are mostly responsible for smaller, local municipal utilities in Germany. The issues that are regulated (e.g. grid operation license, grid access, requirements for unbundling, grid tariff requirements, metering etc.) and the means of regulation (administrative act, license, supervision act, investigation and abuse proceedings) evidence a rigid application of the regulatory regime in Germany.

2. The Energy Transition

The second fundamental change in the European and German energy market came through decarbonisation and decentralisation. The major elements of the energy transition in Germany were the nuclear phase out, the introduction of a European emission trading system, and maybe most importantly, the introduction of a reliable

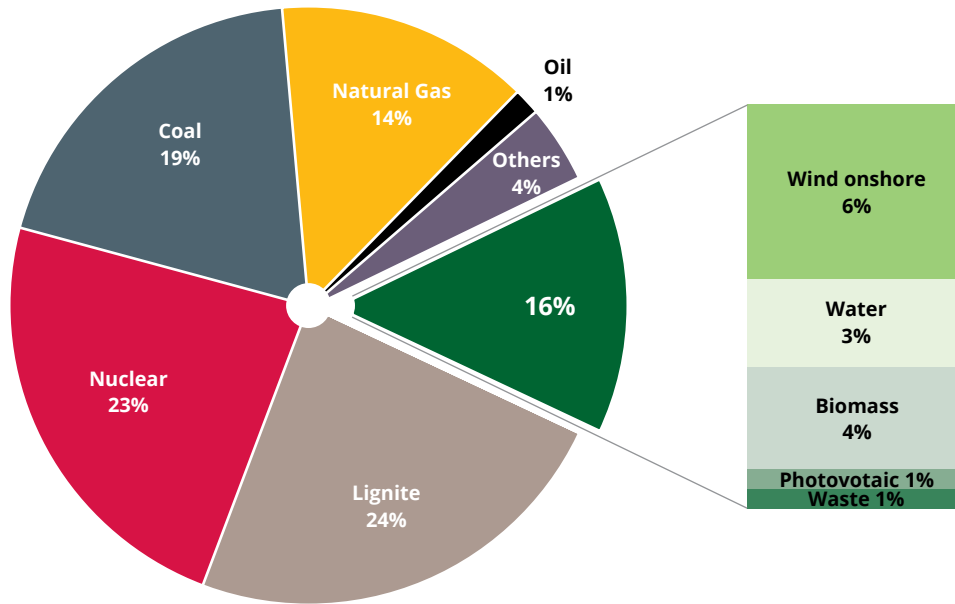
and functioning support scheme for renewable energies via the so-called Erneuerbare-Energien-Gesetz (EEG), the renewable energy law.

Through feed-in-tariffs paid for an amount of 20 years the German legislator created a regulatory framework that attracted investments in the renewable energy sector from new market players such as a range of different small and medium-sized companies, cooperatives, consumers etc. These resulted in enormous growth of renewable energy deployment on the distribution level and a steep decline in the cost of renewable energy technologies. At the same time, the whole energy system was turned upside down. Whereas formerly there were around 150 big central power plants, electricity is nowadays produced by around two million generation units throughout Germany. This poses a major challenge for distribution grid operators in Europe and in Germany in the coming years.

The feed-in-tariffs are financed via the so-called EEG surcharge that is levied on all end consumers in Germany. As the amount of the EEG surcharge currently exceeds the amount of money that is paid for electricity as a commodity, the surcharge became an important element for German energy policy making (e.g. via introduction of exemptions for the payment). The costs covered by

The power mix in Germany 2008

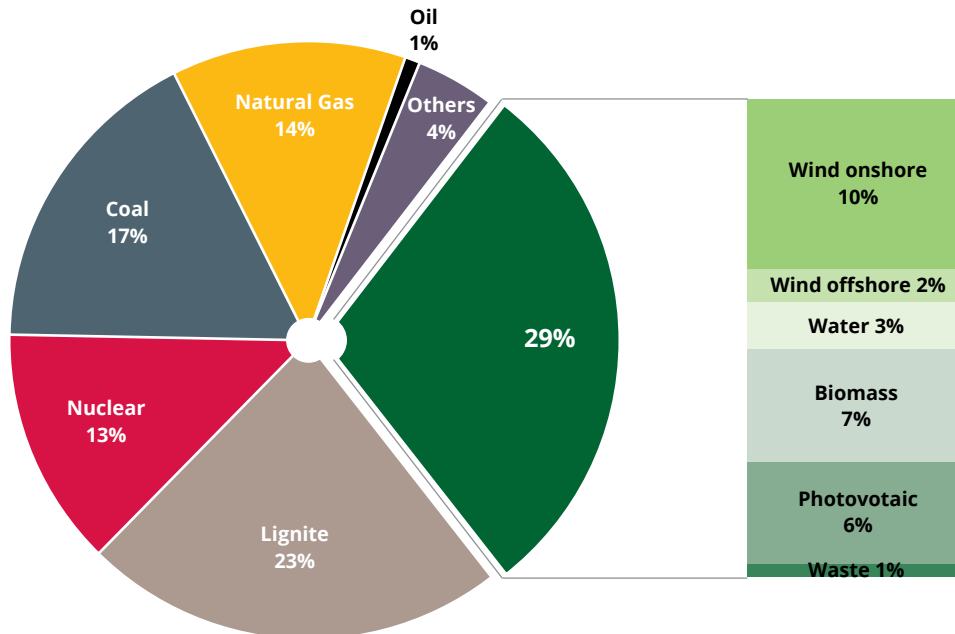
- Renewable energy supplied 16.8% of gross electricity production in 2008:



Total electricity consumption (gross electricity consumption) in Germany was in 2010 **618 Billion kWh**

The power mix in Germany 2016

- Renewable energy supplied 29% of gross electricity production in 2008:



Total electricity consumption (gross electricity consumption) in Germany was in 2016 **598 Billion kWh**

Figure 3: Fundamental elements of the Energiewende

the EEG surcharge currently amount to ca. 25 billion Euro annually. Up until the beginning of 2020 these costs will further increase as offshore wind farms with high tariffs will enter the system (cf. Agora Energiewende, *Energiewende 2030 The Big Picture*, 2017, p. 5).

The EEG and the feed-in-tariff system have had many positive effects in Germany. The deployment of renewable energy plants has been carried out at unprecedented pace and this has led to formerly unthinkable levels of installation of renewable energy capacity. Further, this development has triggered a massive decrease in the cost of renewable energy plants.

However, the costs for the German energy consumer were considerable. In this regard, a discussion with the South African participants took place about the German specificity that small household consumers subsidize large industrial customers (that regularly are exempted from paying the surcharge) and at the same time compensate the PV installations of more affluent property owners that have the space to install PV plants on their properties. This redistribution of wealth from ordinary electricity consumers to industrial companies or more affluent home owners was quite surprising for the South African participants. In South Africa, the reverse is happening: The affluent part of consumers (companies and citizens) is paying the cost for socially disadvantaged part of the consumers that cannot

afford to pay. A system similar to the German one would be unthinkable in South Africa.

3. Operating and Financing the Grid

In unbundled (liberalised) energy systems, the activity of grid operation is regulated strictly and, therefore, grid operators must adhere to a clear set of rules for financing and operating the grid. The differentiation between the regulated part (the grid as natural monopoly) and the competitive market part (trade and supply as well as other activities that are not mere grid operation) and the resulting differences in terms of regulatory and business environment remained a key topic for the entirety of the discussion. The activities of utilities concerning trade and supply, generation, and the provision of energy services are not regulated. This means that there shall be a competitive market in which Stadtwerke can offer these services just as other companies on a level playing field. By contrast, grid operation and financing is regulated and a utility active as grid operator has to abide by the relevant regulatory regime.

The basic rules for operating and financing grid infrastructure changed fundamentally under the liberalised regime. The formerly vertically-integrated companies were split up into grid operators on the one



Workshop participants visiting the waste to energy incinerator of Energieversorgung Offenbach (EVO) GmbH.

hand and trade and supply companies on the other. Grid operators are exclusively responsible for the operation and maintenance of the grid network. Thus, their task is mainly to maintain and expand the grid infrastructure, keep the network in balance and ensure security of supply by guaranteeing the physical transport of electricity at all times. This is done either by a separate company (legal unbundling) or by a separate branch of the Stadtwerke (in this case: unbundling of accounts is necessary).

Also, financing of the grid has to be carried out exclusively by the branch responsible for grid operation. Before liberalisation, integrated energy companies calculated consumer prices on a cost-plus basis including all price elements (grid related and trade/supply related). After liberalisation grid costs had to be recovered under a specific rate-of-return regulatory regime. In other words, a specific regulatory regime applies to all activities of the Stadtwerke branch that is responsible for the operation of the grid network (i.e., the natural monopoly). Further, accounts for regulated and un-regulated activities have to be separated and ring-fenced. At the inception phase of liberalisation in Germany, grid operators were allowed to factor in all their grid costs (OPEX, CAPEX and depreciation) plus an adequate rate of return to set up the regulated revenue basis. Under this system, costs and revenues, in principle, are equal so that the grid operator always recovers all its costs plus a reasonable profit (rate-of-return regulation).

Such a rate-of-return regulation is deemed to be very investment-friendly as it provides for a high level of investment security. This was deemed to be an appropriate system for the transition phase after liberalisation.

Once the system was regarded as fully built up, the German legislator decided to focus on reaching a higher level of grid operation efficiency by introducing a so-called incentive regulation. The aim of this type of regulation is to incentivize the grid operator to operate the natural monopoly more efficiently. The underlying assumption is that natural monopolies are per se not operated efficiently. Accordingly, costs and revenues are decoupled which means that a recovery of all costs is not guaranteed anymore. A revenue cap on the basis of the costs in the so-called base year is introduced that slowly decreases over a certain pre-defined time period. The x-factor creating the decrease reflects the increase of efficiency. As a consequence, grid operators have to increase efficiency in order to remain profitable. The South African participants asked for a clarification how a grid operator could increase efficiency without making personnel redundant. During the on-site visit at Stadtwerke Heidelberg GmbH the question came up again and the Managing Director confirmed that except for the expansion of grid businesses at the same cost (economies of scale) there are not many measures other than removing staff in order to become more efficient.



II. The Energy Transition Challenge in South Africa

The South African electricity sector is comprised of a single vertically integrated utility, Eskom that is responsible for generation, transmission and distribution and distribution undertaken through municipal utilities (mainly city departments). There are roughly 170 registered municipal electricity distributors in South Africa. These utilities account for over 40% of national electricity consumption in South Africa of which 8 cities cover 34% of national electricity demand and 60% of all electricity customers.

The role of local government in energy is initiated in the Constitution. Under Schedule 4b of the Constitution local government has executive authority in respect of, and the right to administer, electricity and gas reticulation (usually referred to as distribution). The 1998 White Paper on energy provides that electricity distribution must be linked into the municipality's infrastructure investment plan, through the incorporation of the Electricity Master

Plan into the municipality's Integrated Development Plan (IDP) and municipal budget process. The Electricity Master Plan is used to establish growth and development required in the maximum demand and the system capacity to meet this.

Although electrical distribution is a municipal function, Eskom is the electrical distributor in many smaller municipalities, and within certain areas, or portions of municipalities. This is historical; linking to the early electrification programme run through Eskom prior to 1994. Attempts to restructure the electricity distribution industry in South Africa in order to iron out inconsistencies and inequities were undertaken post-1994, but abandoned due to municipalities challenging the removal of a perceived key mandate and associated revenue source. In areas where Eskom is the distributor, the municipality must work with Eskom to ensure that any electrification investments in their service territories are aligned with the municipal IDP. Integrated planning between Eskom and local government remains a challenge in many municipalities.

Electricity Industry Structure

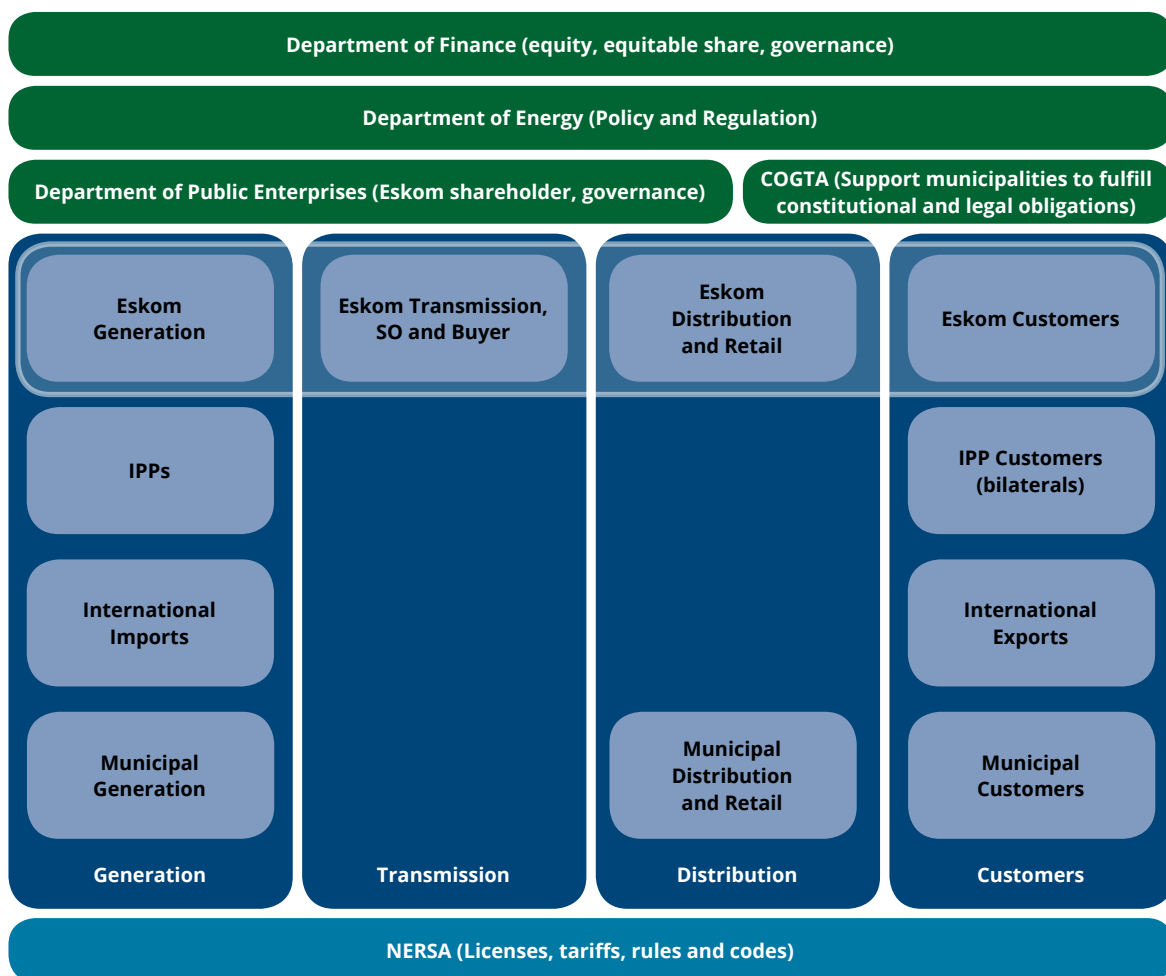


Figure 4: Structure of the South African electricity industry

Revenue generated by Eskom from the sale of electricity within municipal areas flows directly back to Eskom, whereas the municipal utility for electricity distribution is part of local government and thus also part of the complex municipal finance and funding picture, as well as the broader set of municipal mandates. Municipal distributors are responsible for ensuring access to electricity services for the poor, and the allocation of 'free basic electricity' grants. They also draw on utility revenue to provide cross-subsidies for poor households. In the face of 'subsidy stagnation' this is placing increased pressure on the municipal budgets.

Municipalities are also identified within national policy relating to the implementation of energy efficiency and climate mitigation. Many, particularly metros and larger secondary cities, have internal (and global) policy commitments to greater levels of efficiency and lower carbon emissions. These are supported by Constitutional mandates which emphasise that municipal service delivery should be sustainable (financially and environmentally) and responsive to technology change.

Municipal utilities have all experienced sharp electricity price increases (more than 100% since 2007) due to Eskom's supply constraints and expensive new build generation programme. Sales have decreased, with sales in all metros now sitting below 2007 levels. This is due primarily to electricity demand elasticity – with consumers able to respond to rising prices through implementing greater efficiencies and fuel switching – including the move to embedded renewable energy generation in the form of rooftop PV.

Municipal utilities find themselves confronted by declining revenues, ageing infrastructure and heavy "non-technical" losses (criminal activities, affordability). The ability to cross-subsidise the revenue gap through raising levies on the higher end consumers (households, commerce and industry) is now limited as such customers may defect to generating their own electricity through cost comparable rooftop PV systems.

These forces have resulted in municipal utilities being forced to reconsider their traditional business models. However, the exercise is complex as utilities are not 'stand-alone' entities with ring-fenced finances and they operate in a national terrain that has a number of policy 'grey areas' relating to the national electricity plan and the liberalization of the electricity sector. Municipalities and their utilities are engaging in new approaches in various exploratory ways, including load management, putting

in place processes for small-scale rooftop PV embedded generation feed-in and related tariffs, alternative services delivery (solar water heating, gas, micro-grids), undertaking 'own' renewable energy generation through waste-to-energy or small-scale hydro projects, wheeling of power from Independent Power Producers (IPPs) to willing buyers, and exploring the possibility of power purchase agreements with IPPs. Substantial policy areas remain to be addressed, including areas such as regulations relating to third-party electricity wheeling and legal challenges relating to procurement from IPPs. Technical and financial issues also arise around metering and billing.

The key lessons that were drawn from the German exchange relating to liberalisation and energy transition were the following:

- A fundamental transition in the energy sector requires a tremendous amount of political vision and force: in Germany the processes were partly driven by the EU and decades of political activism against the use of nuclear power and in favour of renewable energy.
- Transition processes take a long time and are ongoing/iterative. A political and regulatory culture of trial and rework is necessary.
- Every transition process carries risks (especially for incumbent companies), but it also creates new opportunities. In order to soften political struggles and to create win-win situations, the incumbent companies should be involved in the process.
- The process of liberalization can apply differently and may not be suitable for smaller municipal distributors. In the EU, there is a de-minimis-rule so that companies with less than 100,000 customers can be exempted from certain unbundling requirements.
- A liberalised system requires a strong and independent regulator. The regulator must be able to take decisions based on the rule of the law and in a way that creates trust amongst market participants that decisions are in the best interests of general welfare.
- Reliability and certainty of governmental activities, tariff structures and levels, and fundamental market principles are essential to foster long-term investment.

III. The Structure of Municipal Utilities and their Role in the Energy Transition

The energy industry in Germany has always been pluralistic, i.e. from the very beginning it functioned based on strong involvement of municipalities that were held to be responsible for providing “Daseinsvorsorge” (basic service delivery for the public) such as provision of electricity, heat, and water. This strong role for municipal activity also holds true for other economic areas and the principle of self-administration has been laid down in Article 28 (3) of the German Basic Law. From this derives the definition of municipality in Germany as a local state entity with comprehensive autonomy.

The majority of German Stadtwerke is organized as companies with limited liability (GmbH) and are generally 100% owned by the relevant municipalities. Privately owned energy companies that hold stakes in German municipal utilities do also exist, but they represent a minority. Regarding the internal structure, it is noteworthy that the supervisory board of Stadtwerke, generally, consists of members of the local council (Gemeinderat) and is headed by the mayor of the municipality. Further, a representative of the employees of the Stadtwerke is regularly a member of the supervisory board. This demonstrates very well the extent to which municipalities are interlinked with the business and operation of their respective Stadtwerk.

It is noteworthy that Stadtwerke are essential for the functioning of the German energy market. They are the main point of contact for the end consumers and, generally (due to the de-minimis-exemption) act as supplier and distribution grid operator at the same time. Hence, all consumer-related issues arising (e.g., non-payment issues, energy poverty issues, shortages, grid defects, thefts etc.) are handled directly by the local Stadtwerk. This shows the importance of having a local energy company that is in the hands of the local population and that is not only profit-oriented (as opposed to a regional or supra-regional privately-owned company).

But the importance of the Stadtwerk for the local population and the municipality go beyond this. In many cases, economic profitability and well-being of the relevant Stadtwerk is of immense importance to the municipality. Annual profits of the Stadtwerk constitute a considerable part of the budget of a municipality. As integrated companies, Stadtwerke are not only active as grid operators and suppliers of electricity and/or gas but also play a major role in the public transport sector and in maintaining other municipal infrastructure (e.g., swimming pools, electro-mobility, roads). The Stadtwerk generally is an important employer in the municipality and its investment decisions play an important role in the

infrastructure development of the municipality.

There are similarities across Germany and South Africa with regard to several points on municipal utilities: In both countries the role of municipalities in providing basic services to local citizens is enshrined in the Constitution; municipal utilities have a long tradition of providing energy services to local customers; the municipal entities are politically steered by the local officials; municipal utilities can create local jobs; if run profitably and efficiently, municipal utilities can produce income for the budget of the municipality and improve the day to day life of local citizens.

However, in terms of constitutional law, the competences of the municipalities in this field in Germany seems to be clear and settled, whereas in South Africa there is a fundamental dispute before the constitutional court concerning the determination of municipal competences in the field of energy distribution and supply.

A clarification of the competences is important to enable municipal utilities to be clearly aware of the types of business they can conduct and the services they can provide.



IV. Distributed Generation and Grid Tariffs

1. Distributed Generation and Decrease of Grid Tariff Payments

For many reasons (particularly decrease in costs of PV and wind power generation), there is a global trend towards self-generation and self-consumption of electricity. This development allows to further unlock the potential of PV and wind power generation. However, at the same time there is an increasing problem with regards to the question of how the costs for building, maintaining and operating the general grid network can be recovered adequately. In other words: If an increasing number of customers uses less electricity supplied by the general grid and consequently pays a smaller amount of grid tariffs, the recovery of total grid costs becomes increasingly difficult. In the worst case, this ultimately causes a reduction of grid services which motivates more consumers to invest in embedded generation technologies to avoid grid dependency. This leads to a self-enforcing mechanism of shrinking payments for grid service and deteriorating quality of these services.

Although in different forms, this problem similarly exists in Germany and South Africa.

In Germany today, there are intense discussions regarding measures to reform the structure of grid tariffs. However, the main problem in Germany does not stem from PV production. Less than ten percent of all PV system operators currently use their system for self-consumption. The majority of PV electricity is fed into the national grid. Based on the nationwide annual electricity requirement of around 600 terawatt hours (TWh), solar PV self-consumption amounts to about 2 TWh with a share of just 0.3 percent. A bigger problem for shrinking grid tariff payments is the growing share of industrial customers that are either exempted from grid tariff payments or invested in self-generation to avoid or reduce EEG surcharge and grid tariff payments.

In South Africa, rooftop PV provides an attractive business case for consumers, particularly within the commercial sector where most of power can be self-consumed during the day (the most cost-effective approach within the current South African tariff regimes). This has resulted in a remarkable growth path for embedded PV plants during the last years. As large shares of the national power supply are generated by aging coal power plants, this structural transition should be warmly welcomed: each private investment in solar power and energy storage will reduce the necessity for investments in new power plants.



Discussion between German and South African participants at the policy discussion workshop on energy market design and municipal utility business models.

However, each kWh that has been additionally generated by embedded PV reduces users' contributions to fixed/sunk and operational costs.

Hence, in both countries, there is a need for grid operators to establish tariff structures that allow for an adequate level of return in order to maintain current grid service levels. In both countries, similar solutions are approached. In Germany, there are concepts to increase the share that is paid for electrical capacity (per kW) instead of calculating the major part of grid tariffs based on electricity consumption (per kWh).

For South Africa, a couple of different approaches are discussed: a fixed charge per customer, a peak capacity charge, a charge which addresses different types of customers (e.g. consumers and prosumers), a gross instead of a net meter based charging (including feed-in volumes) or a multi-part tariff charge (e.g. a combination of a fix and flexible component). A complexity in South Africa is that the majority of customers are on prepayment meter systems. Therefore, the reintroduction of a fixed charge into the prepayment meter could be challenging.

2. The Business Models for Self-consumption and Opportunities for Municipal Utilities

A useful way forward is to understand the most widely adopted PV prosumer business models for distributed PV, analyse the technical and economic impacts on

grids and markets and develop concepts and supporting regulations for prosumers to maximize their benefits for the grid and electricity markets. In a 'generic' distributed PV business model the excess PV electricity is fed into the grid in exchange for a feed-in tariff. The residual electricity demand is sourced from the grid. The business case for the project results from differences between the grid electricity price, the feed-in tariff for the excess PV electricity and the cost for the generation of the PV electricity (Levelized Cost of Electricity "LCOE").

Municipalities should consider their response to prosumers considering both the short and longer-term challenges and opportunities. In the **short term** fixed charges for connected PV systems using the grid as a back-up may be a necessity in order to refinance grid infrastructure. However, this should not result in rendering PV investment uneconomic but rather be used to incentivise grid friendly operation of PV systems.

In the **medium-term** PV systems should be required to provide grid stability services (e.g. demand side management by reducing peak loads) which allow grid operators to save costs especially in distribution grids. In addition, utilities may offer leasing and maintenance of PV systems to generate additional revenues and, most importantly, to increase customer retention. The utility can support with the integration of heat appliances (e.g. heat pump, hot water storage) and ensuring effective control strategies.

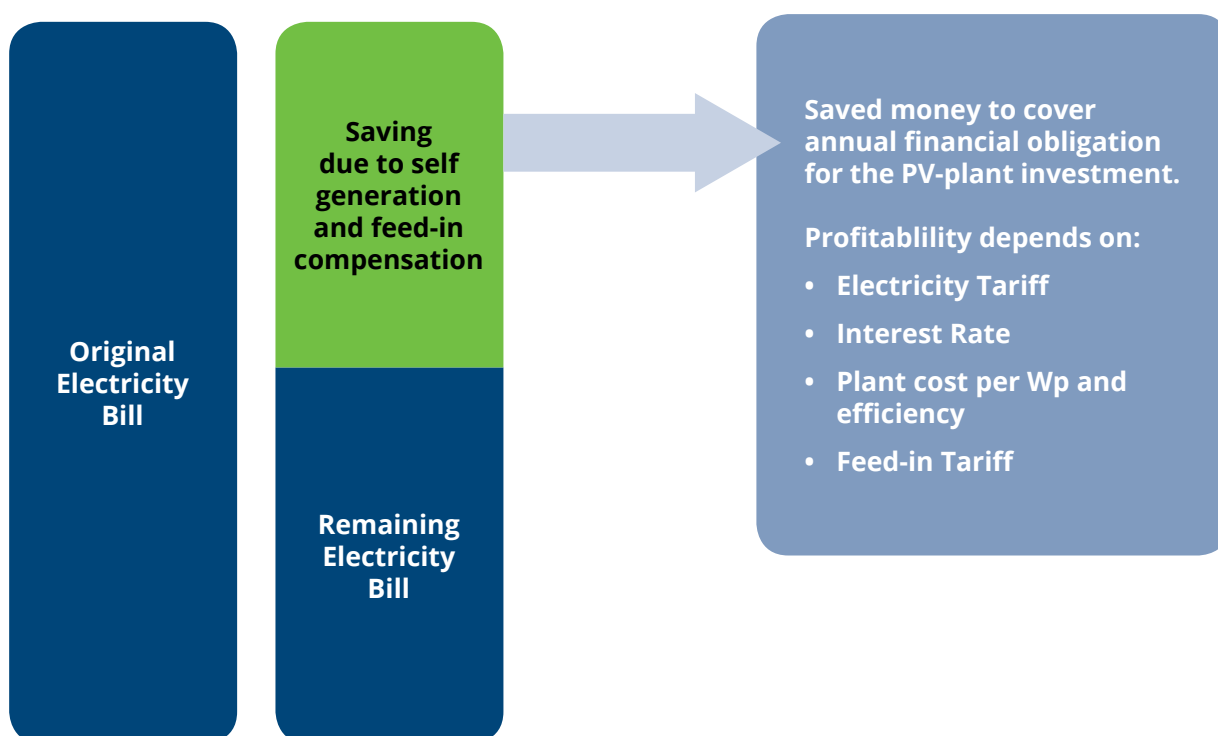


Figure 5: The composition of generic distributed PV business models

In the **long-term** a swarm of PV-batteries controlled by the local utility can help to balance grids by utilizing ample capacities for charging or discharging. Providing services for e-mobility is another area for potential additional services provided by a utility.

Currently the framework conditions in South Africa and Germany differ considerably. In South Africa, there is no certainty for financing of PV. A variety of feed-in tariffs (export rates) are set by municipal utilities and Eskom and these can change from year to year. This is a challenge in terms of securing investment in the sector and the sensitivity analyses all indicate that this has a major influence on further investment. Inflation and interest rates also have a big impact on viability of investments. In South Africa a 3–5-year return on equity is ‘required’, whereas investment in embedded PV is around a 10-year payback. It would be necessary to find concession finance to ‘top this up’ to get market scale (e.g., to bring return on equity down to at least 7 years). In Germany, interest rates are low, plus there is a lack of opportunities to invest. Therefore, there is a lot of capital in the system. There is also a culture of investment in green technology if spare cash is at hand. Further, utilities in Germany have strong balance sheets which allow them to get financing for PV leasing more easily.

3. Prosumer Metering

Regarding prosumer metering there are two basic approaches available:

Gross Metering: The PV-System is directly connected to the utility grid and the entire PV-Solar power generated will be transferred to the grid.

Net Metering: Self-consumption of the PV-Solar energy is the first choice and only excess power generated is transferred to the grid. Where remuneration for the excess power is at the retail rate, this is known as net metering; where the excess power remuneration is below the retail rate, this is known as net billing.

From a prosumer perspective net metering will directly reduce the electricity bill, while with gross metering the bill remains unchanged as the customer will receive a payment for the transferred energy.

From a utility perspective gross metering is not directly reducing the revenue side as the payment for the PV power

fed into the grid is covered through a different budget (e.g. a feed-in tariff financed via a surcharge). Net metering in contrast will result in reduced sales and thus in potential revenue losses as only the delta of power import/export will be billed. While the attractiveness of gross metering is depending on the feed-in tariff only, the attractiveness of net metering is related to the retail electricity tariffs.

Where a utility offers an unattractive net-metering/billing tariff it runs the risk of losing prosumer customers who will increasingly invest in batteries. The price of batteries is falling and the system technology is becoming a plug-and play option. A bolder net metering approach, as demonstrated in the Netherlands and Belgium (Flanders), views the grid as the battery and places the emphasis on customer retention. In the discussions, delegates from South Africa were interested in a net metering/billing approach, but considered a 1:1 pricing ratio for sold and incoming kWh as too onerous on the system, and proposed rather an indicative 1:0.7 net-metering/billing ratio. Support on setting adequate net billing tariffs is provided by SALGA/GIZ using a user-friendly excel tool.¹

Key lessons and concepts emerging from the discussion were the following:

- New approaches to tariff setting are required to manage the impact of own PV consumption. All adjustments to respond to the grid revenue collection challenges require a clear cost of supply structure and the collection of reliable data. Stability and uniformity of grid tariffs and feed-in-tariffs are essential for investment security.
- In Germany, grid costs are spread across all consumers based on anticipated electricity and capacity demand. The grid tariffs are billed by the supplier as part of the end consumer price. Grid tariffs are cost-reflective, transparent and only differ slightly across the country (compared to South Africa). Excessive self-generation rates might be addressed by increasing the “capacity element” of grid tariffs.
- The transmission grid and the distribution grid are public goods and a case could be made for spreading the costs of maintaining and operating the grid across all citizens (progressively), whether connected or not (e.g. through the rates accounts, levies elsewhere in the system, such as fuel levies, carbon taxes).

¹ Tool: <http://www.cityenergy.org.za/getfile.php?id=437&category=5>
 Model Guideline: <http://www.cityenergy.org.za/getfile.php?id=436&category=5>
 City of Tshwane Net Billing Tariff Report: <http://www.cityenergy.org.za/getfile.php?id=431&category=5>

V. New Business Models for Municipal Utilities

The business model of municipal utilities in Germany is shifting away from traditional revenue streams based on energy supply to alternative models, such as selling energy services to the customers. Traditionally, there were three pillars of activities for Stadtwerke in the electricity value chain: generation, distribution and supply. In a long-term perspective, this will change fundamentally due to liberalisation, energy transition, and digital transformation.

1. Impact of Liberalisation and Energy Transition on Traditional Business Models

Before the market liberalization, the overall rate of return levels of Stadtwerke in the three branches were as follows:

After liberalisation and the switch to an electricity system based on renewable energies, the market conditions for Stadtwerke became much more difficult.

In the regulated space, i.e. the “wires business” or the area of grid operation, Stadtwerke are bound to regulation that foresees a regulated rate of return that is determined and fixed in advance by the National Regulatory Authority. As explained above, under an incentive-based regulatory regime, a grid operator can only achieve a higher return on its investment by increasing efficiency. In practice, this is hardly possible because there are no other measures than layoff of personnel to increase efficiency when revenues remain relatively stable. However, as the rate of return is guaranteed by law, the “business” of grid operation is relatively risk-free. Therefore, grid operation remains a profitable business, although with lower income than before.

In the unregulated competitive market segment, the challenges for Stadtwerke are totally different. The business

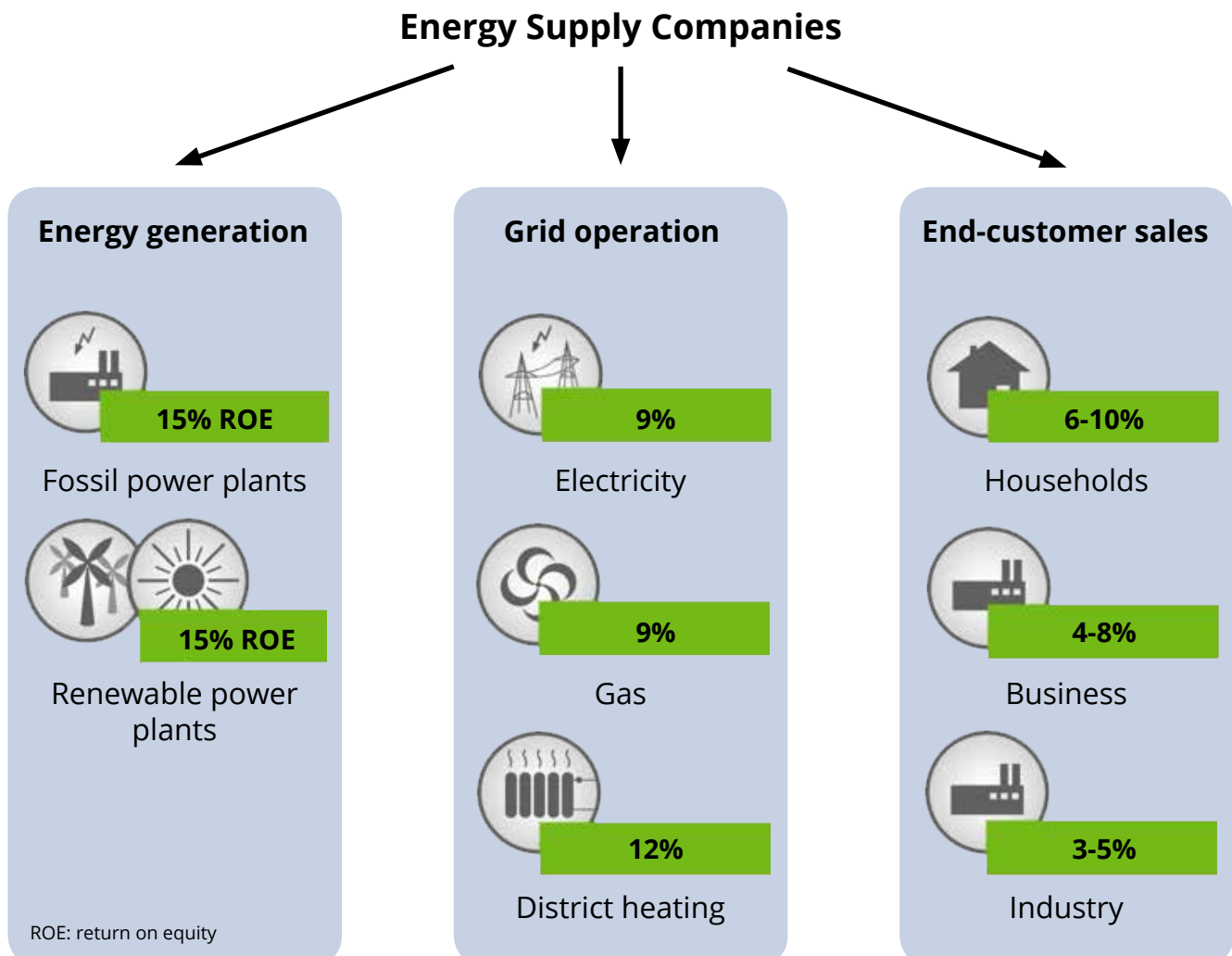


Figure 6: Corporate profits of a Stadtwerk before liberalisation

activities of Stadtwerke in this area, i.e. generation, trade, and supply of energy, and the provision of energy services nowadays take place within competitive markets. Hence, Stadtwerke compete with all other market participants on a level playing field. Successful Stadtwerke can gain higher profits than in the regulated grid sector. But conducting successful business operations did not turn out to be always easy for Stadtwerke.

In supply and trade of electricity, new competitors entered the markets quickly. These were new types of energy supply companies that based their business on nationwide supply activities (as opposed to Stadtwerke that were traditionally bound to their respective supply area). On the other hand, Stadtwerke themselves started to become active beyond their original supply areas and started to compete for customers in areas where they had not been active before. Currently, a typical household customer in Germany can choose between around a 100-150 different supply companies. It is obvious that trade and supply margins are shrinking in a market with such a high degree of competition.

For Stadtwerke, a comparable development took place in the generation sector. As explained above, the guarantee of fixed feed-in-tariffs led to a decrease of wholesale electricity prices and reduced the amount of electricity that could be sold by traditional energy companies. Energy companies that did not invest in renewable generation technologies but stuck to conventional power generation (especially gas-fired power plants) experienced considerable losses on energy generation investments.

Due to fierce competition in the market for supply, trade, and generation, these branches have become less profitable compared to the regulated markets of grid operation. Accordingly, the margin levels in the different branches of utilities are nowadays considerably below the former profitability levels 10 years ago. It is clear that the traditional business models of Stadtwerke, focussing on the production and sale of the commodity electricity, do not work anymore.

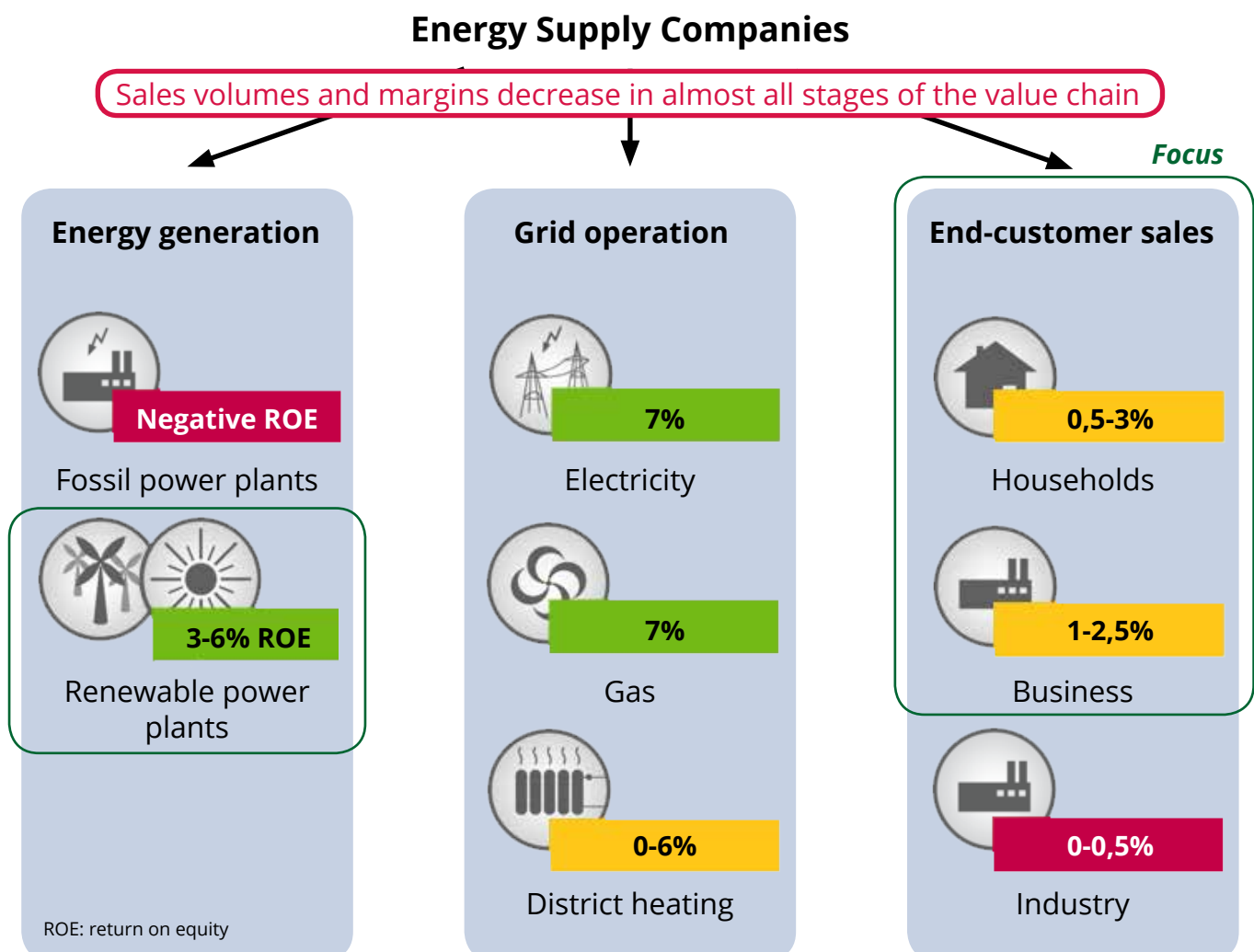


Figure 7: Corporate profits of a Stadtwerk after liberalisation

Workshop participants visiting
the waste to energy incinerator
of Energieversorgung Offenbach
(EVO) GmbH

2. Switch from Provision of Commodities to Energy Services

There is a clear trend that companies traditionally active in the provision of commodities (electricity and gas) will increasingly need to switch to providing energy services to clients. These underlying market developments are offering opportunities and challenges for market incumbents as well as for new market entrants. While incumbents have to reinvent or rethink their business models, new entrants are more flexible and agile, thus they are able to gain significant market shares from traditional municipal utilities.

The growing influence of distributed generation technologies, smart grid technologies, reduced energy consumption due to energy efficiency, and energy management activities as well as demand-response technologies are triggering the invention of new approaches to making business.

A further reason for changing business models is digital transformation: Formerly, the direct link municipal utilities have to the end customers was a considerable competitive advantage. However, customer behaviour changed during the last years – digital transformation and the spread of smartphones make it indispensable for municipal utilities to “digitalize” their services. Customers want to be able to access offers, accounts and services online. If municipalities do not move into this area, they will lose out to more active competitors.

The traditional advantage of Stadtwerke, being close to the customer and often having a personal relationship with the local citizens, decreased due to these developments. Today, customers increasingly change electricity suppliers via one of the different available online platforms such as Verivox (www.verivox.de) or Check24 (www.check24.de). Coupled with increased competition from new market players and the increase in self-generation and small scale renewable energy production, the competitive situation for the Stadtwerke has changed fundamentally in recent years.

As a result, there is a growing necessity for municipal utilities to invest in infrastructure and information technology, and develop new business models. These challenges can be mastered by new collaborations, also with new players from other sectors. Stadtwerke have



to radically rethink their business models and strategic position. Against this background, it seems obvious that the provision of energy services will become a major field of activity for municipal utilities. Utilities are developing new business models based on digitalization and decentralization of electricity generation. These include, for example, the following new concepts:

- the bundling of decentralized energy storage concepts to provide large scale and flexible storage solutions;
- provision of consultancy services and leasing services with regard to PV power plants and energy efficiency topics for end consumers with onsite consulting. These business models are based, again, on the advantage of the local proximity to the customers;
- other promising opportunities for new energy services are based on addressing the customer needs “behind the meter”, such as: energy storage, electro mobility, load management, efficiency contracting, contracting for distributed power generation, smart home products, facility management services and the marketing of consumer-flexibility due to virtual power plants;



- smart meters allow other business models, such as load controls down to the individual apartments or houses, so that customers can benefit from cheapest electricity prices and an optimization of electricity costs is realized. This, for example, has implications on such activities as the overnight charging of e-mobiles;
- green energy solutions for energy-autonomy of municipalities;
- participation in the balancing market with specifically designed storage facilities.

Further examples can be found in the publication “New Business Models for Municipalities in the Electricity and Energy Sector – German Approaches” of the South African-German Energy Partnership².

In the medium term, internet-based transaction platforms will be established in the energy sector, as they have already arrived in the financial sector through virtual currencies. Blockchain-technology has large implications for trading of decentralized electricity generation within prosumer communities. Since these platforms are decentralized and transparently organized,

they present another threat to municipal utilities. The prosumers (as former customers of a local Stadtwerk) who are involved in a blockchain transaction are no longer relying on a utility as mediator to clear the bill between different parties. However, even today, grid operators are still necessary to implement the market communication processes as well as balancing and scheduling.

Stadtwerke are also developing solutions to intensify their sales success based on cooperation. A common approach is the so called “white label models” – a sub-company provides the service for another public utility company and co-ordinates the added value in the background. Usually the cooperation of the different Stadtwerke takes place “behind the curtain” and is not apparent from the perspective of the end customer.

A second approach is the marketing of services to third parties (smaller Stadtwerke) to leverage scaling effects. Larger utilities try to achieve economies of scale by offering services and utilities in many areas of energy supply based on a business to business to customer approach, which they also offer directly to their own customers. Examples for this strategy can be found in energy sales/trading as well as for efficiency services.

An example for an innovative Stadtwerk is the Stadtwerke München GmbH in Munich, where the local municipal utility provides a platform to bundle large scale PV plants within a virtual power plant. PV plant operators receive a transparent market-fair remuneration from the Stadtwerk, while the municipal utility optimizes the marketing of the electricity generated, taking over the marketing risks and keeping the profit.

An example for new market entrants are „sonnenCommunity“, a community of battery storage owners of the so called “sonnenBattery”. Within this group, members can trade self-produced energy with other members of the sonnenCommunity. Since the community organizes the electricity supply for the excess demand, there is no need for conventional energy providers in order to satisfy the demand of energy.

The key messages that could be derived for municipal utilities in South Africa were the following:

- Develop a visible presence/interface with customers.
- Develop new business ideas along the whole value chain.
- Partner with the private sector and try to improve the customer relationship to build up trust.
- Develop a portfolio that includes generation (own generation as well as PPAs with large scale generators), new products for customers, and services that are beneficial for the municipality and local citizens etc.
- Become a data centre and invest in new data technologies.

VI. Conclusions and Way Forward

As a result of the discussion in Germany, all participants of the policy discussion workshop in December 2017 jointly discussed an action list including recommendations for further considerations on the future design of the electricity distribution industry in South Africa. The workshop participants resolved that (if implemented), these recommendations could contribute towards the advancement of the South African energy sector. They include:

- Knowledge exchange platforms between experts of the South African energy sector should be established or revived;

- Current “bundle”-tariff-regulation (bundling of network and supply) should be reviewed to ensure sustainability of the business; to do so,
- Cost-of-supply (COS) studies provide a strong framework and management tool for sustainable business operation. More generic and practical methodologies are needed for harmonizing COS-results and also for improving the interpretation thereof. COS-studies can furthermore be an enabler for responding to other emerging business trends such as SSEG or wheeling;
- Generic Cost-of-Supply-study methodologies should be accompanied by capacity development, e.g. a cost-of-supply training course (“basic regulatory management course”);
- Policy development discussions that are focused on revisiting the energy market design should be supported; this could include providing input into a Eskom business model review from a municipal perspective;
- Improvements of the legal framework of municipalities through securing regulatory clarifications that relate to licensing, Small Scale Embedded Generation (SSEG), Third Party Access (TPA), capacity determinations and determined off takers should be encouraged.
- Municipal energy planning including solutions to diversify the energy supply is becoming more relevant;
- A common understanding around third party transportation/wheeling should be established; this could include an “implementable” proposal for the amendment of the current NERSA TPA legal framework;
- Wheeling frameworks could be considered based on reasonable use-of-system charges (based on the updated Cost of Supply-studies);
- The development and testing of new business models that are focused on customer retention, new sources of revenue, improved services etc. could be further explored. Opportunities may include digitalization, leasing of generation assets (e.g. rooftop-photo-voltaic systems, charging stations for e-vehicles, trading of balancing power, smart electric geysers etc.)

