EMPOWERING SMART UTILITIES MECOMS™

E-Learning
Energy and Utilities

CERTIFIED FOR
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Introduction to Energy and Utilities

1.1 Introduction

Welcome to the introduction of our E-learning: Energy and Utilities. In this module we will be handling what the Energy and utilities market actually means to us. Secondly we will go into the difference between a regulated and a deregulated market and finally we will look into some challenges utility companies are currently facing.

1.2 Commodities

Typically we would think of water, gas, electricity, district heating and cooling. Yet one could also consider a fiber connection for internet service, or even a waste water connection.

A characteristic of a commodity is that consumption in many cases would be calculated on data retrieved from a meter. However unmeasured connections are possible as well.

1.3 Unmeasured connection – consumption unit

If we consider water e.g. it is quite common that there is no meter whatsoever. Customers in this case will be invoiced based on consumption units. This could be the amount of inhabitants, or could be based on the amount of taps, lavatories, showers and bath tubs.

1.4 Balance

To ensure the security and quality of supply, the network needs to be in balance, implying that supply and demand need to correspond. Let's consider electricity and gas. If there is no balance between the production and the consumption of electricity this might result in power outages.

Also the gas network needs to be kept in balance. To allow the movement of gas there needs to be a minimum pressure in the gas lines. To guarantee safety there is also a maximum pressure. This implies the pressure of the gas network needs to be

within certain limits at all times and to achieve this, a balance between demand and supply is required.

1.5 Forecast

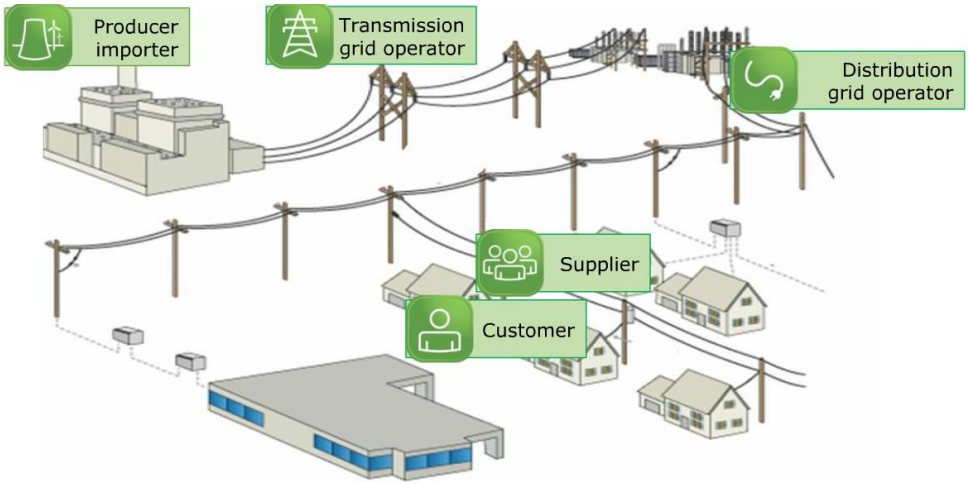
Knowing how much energy will be needed, will help in tuning the amount of energy that needs to be produced, yet providing an accurate prediction or forecast is quite the challenge especially when forecasting a long time beforehand. Given the possible consequences, and the fact that a forecast will hardly ever be spot on you can understand that the network or grid needs continuous monitoring. This will allow the timely corrective actions to be taken such as increasing or decreasing the production or import of electricity or gas.

1.6 Energy trading

The concept Energy and Utility market can also be regarded as the financial market in which energy or utilities are being bought and sold, or in short being traded. This could either be long term in the futures or forward market or short term in the spot market.

The main players in the energy trading are (1) the electricity producers owning the generating stations who sell their production and (2) the electric ity suppliers who will buy electricity in the financial market to subsequently sell for consumption to the end customer. Trading can take place on stock exchanges or through a direct agreement between the producer and supplier.

1.7 Supply chain



There are a few different steps in the supply chain going from production to consumption of energy.

Obviously energy first needs to be produced or imported.

Secondly it will be put on the transmission grid to be transported over long distances. The transmission grid will transport electricity using high voltage or gas using high pressure.

Once transported, the energy will be taken from the transmission grid to supply large scale industrial customers and to be distributed to the small scale and residential

customers. To do so the electricity or gas will be transformed to low voltage or low pressure and will then be put on the distribution grid.

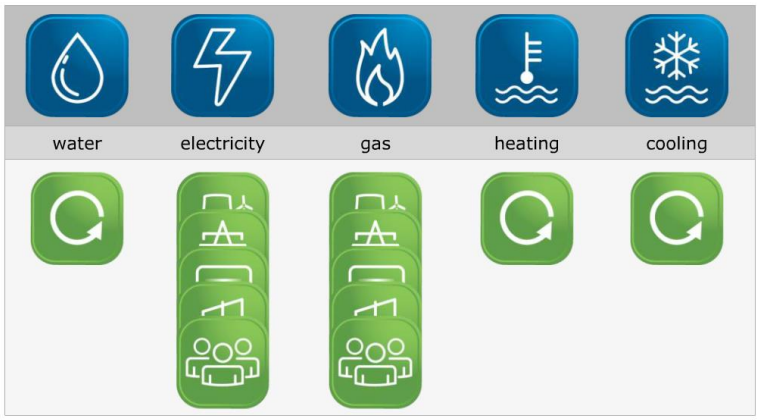
Using the distribution grid the electricity or gas will reach the meter into the customer's home network at the final stage. The meter will then be read on a regular basis in order to be able to calculate the consumption amount and the price that needs to be paid.

1.8 Regulated versus deregulated market

In a regulated market the transport, supply and meter reading, by example, would be performed by one main company which basically held a monopoly. In quite some cases this company was government owned or funded. Production or import needs to be considered separately as not all countries dispose of electricity generation capacity or natural gas resources and the utilities might have been traded or imported.

During the last decades however, utility markets have increasingly become deregulated. This means that the individual roles are picked up by separate companies. Through a process of unbundling, energy transmission networks were separated from the production and supply side by enforcing that these be run independently. Given the complexity of transforming, what could be called an energy monopoly into a market with multiple players, it is needless to say this did not happen overnight.

1.9 Current status



When we currently take a look at the energy and utilities market we see that depending on the commodity and the possibility to have an open and competitive market, deregulation has taken place. Looking at multiple countries we could say that for water, heating and cooling typically no competition is available due to the nature of the commodity whilst for gas and electricity most countries have completed deregulation or are in the full process of doing so.

1.10 Challenge (1)

1.10.1 Competition

The most visible consequence to the consumer is that they can now select a supplier of their choice. Utility companies are now facing competition and the need to increase

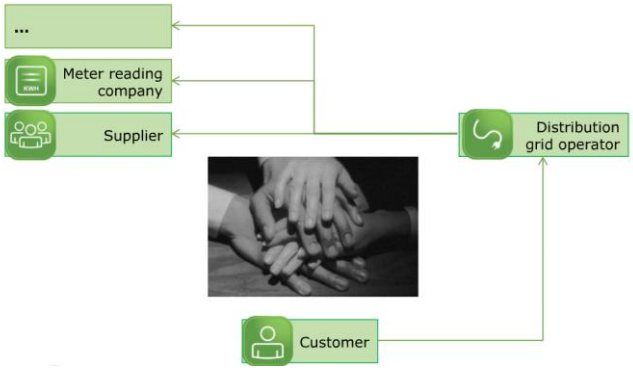
their efficiency and to reduce their costs as the educated, cost-conscience customer can compare multiple suppliers and their prices. A much desired benefit of introducing competition would ultimately be a decreased price for the consumer.

1.10.2 Collaboration

Deregulation has drastically changed the way energy companies operate. Several utilities in Europe have been forced to split their distribution and supply operations. In some countries, liberalization has even gone to the extent of forcing companies to yield metering and balancing responsibilities. These companies now face the enormous challenge of fundamentally rethinking their organization and business processes. Additionally, deregulation has led to increased market complexity.

1.11 Market interaction

Consider a customer requesting a new connection to be installed. In the regulated market he would simply have had to contact his supplier, who would then have steered the right department. In a deregulated market, the customer would need to contact one of the different market parties, e.g. the DGO. After installation, it's the task of the DGO to inform all the other parties.



This example is just one of the various processes which calls for communication between the different market parties. They could do so by sending an email, yet keeping the size of an average customer base in mind this would not be the most efficient approach. Instead the interaction between the different market parties has been standardized and automated into what can be perceived as complex rules of interaction. Any company licensed to operate will need to adhere to these rules. Since these rules are evolving, utilities are faced with the constant challenge of keeping up with new rules and interfaces.

1.12 Challenge (2)

1.12.1 Depletion of resources

Energy can be produced relying on fossil fuels counting on coal, oil and natural gas to supply most of the energy needs. At some stage these natural resources will be depleted. Fossil fuels also cause air, water and soil pollution, and contribute to global warming. Hence we are seeing an increased amount of renewable energy sources. These sources are renewable and eco-friendly. Examples are solar energy, wind energy, hydropower, geothermal and tidal energy.

In several countries solar panels seem to pop up like daisies, both large scale investments in solar power plants and Average Joe's relatively small scale solar panel for self-consumption. The production of energy through renewable energy does pose quite the challenge. As the amount of energy generated by wind energy or solar panels is inconsistent this will need to be balanced by input from conventional power stations. If there is a large influx of energy from the renewable source this would imply that the power station would need to reduce production. Nonetheless they do need to remain available, implying that they need to be constantly available making them inefficient and expensive. Ramping the plants up and down would produce so much CO_2 that overall emissions might be increased rather than reduced.

1.12.2 Increasing demand

Finally we see an ever increasing demand. If we would compare the current demand to that of the 50s or 60s we would notice a substantial increase. Not only have the populations increased, yet also the consumption of each customer individually has increased. Expectations are that this trend will continue over years to come and one could wonder if the current network would still be able to handle this.

Changing a customer's consumption pattern can help with balancing the load on the network. Customers will need to be educated so they can make conscious and smart decisions when it comes to consumption. The perfect example of an incentive to change consumption patterns has been the introduction of multiple tariffs. By applying multiple tariffs a customer would be paying a cheaper rate for electricity used during the night. Also technological developments may help in load balancing the network. Think of smart grids, in which a customer's meter and appliances will be able to communicate both with each other and with the grid, and individual appliances could be switched on or off automatically depending on the network load at that time. Smart grids are currently still in their early stages but may very well play a big role towards the future.