The energy transition process is creating new energy value chains. New stakeholders are emerging, obliging traditional market players to redefine their roles. New fields of expertise and new technologies have to be developed and changes made to the regulatory framework. Transition is an inherently uncertain process, whose exact outcome cannot be predicted. As a result, no single market player can shoulder the associated risks alone. The established stakeholders and the market entrants need to work together in a radically different way. To facilitate this process, innovative business models are required to prevent all the initiatives dying a premature death. KEMA is well positioned to play a catalyzing role in these new value chains, particularly acting in an intermediary role to free up stiff links.

Text **Marjolein Roggen**

Managing new energy value chains

Photo: David Bouman

Transition is the process of moving over to a sustainable way of living, which balances the often competing interests of environmental protection and economic prosperity. As the fuel of the economy, energy is one of the primary focuses of this transition process, along with water and food. Climate change and global crises affecting the energy supply system and, more recently, the wider economy make energy transition an urgent need.

Building blocks

"Formulating sustainability objectives for the medium or long term isn't too difficult," according to KEMA consultant Edward Pfeiffer. "The problem is that nothing much has been happening in terms of realizing those objectives. No one is quite sure how to get from where we are to where we want to be. We feel we have a moral obligation to look beyond our strict remit and take in the bigger picture. It's all very well wanting to generate electricity by sustainable means, but it starts by using energy more efficiently – by going over to more economical airco systems, for example. We have a lot of building blocks from which to construct customized services."

"No one is quite sure how to get from where we are to where we want to be" – Edward Pfeiffer

Risks

KEMA consultant Joep Offerman believes that a number of conditions must be fulfilled for the transition process to be successful. "Transition entails risk: risk that market players have to be willing to accept. That implies first establishing what the risks are and getting the relevant actors to communicate effectively about those risks. We can help in that regard through risk assessment and risk management based on process control. There is also a real need for new strategic business models. It isn't yet clear what roles the existing market players or those who are just entering the market will ultimately play, or how they will interact and with whom. A transition process can succeed only if everyone says, 'We are going to address this challenge together. Even if events take an unexpected turn, we will continue to work closely together and share our knowledge.' When things go wrong, it's no good turning to the next person and saying, 'that's your problem,' and pulling the plug. As the old saying goes: a chain is only as strong as its weakest link."

Photo: David Bouman

Right setting

Along with risk management, it is important to have stimulation from the state. "The government has to create a setting in which transition can take place," says Offerman. "That means not only developing a structural approach to funding and commissioning technical feasibility studies and economic viability research, but also adapting the regulatory and licensing regimes to reflect the new situation. It really doesn't help when, for example, it takes seven years to get a permit to build a wind farm in the Netherlands. And, if the power grid needs upgrading before the wind farm can be connected, you are several more years down the line before a brick can be laid." Another important factor is that many renewable energy projects are not economically viable on a standalone basis – making it is necessary to seek functional integration. "A solar panel is much too expensive to power a water pump in a developing country," illustrates Pfeiffer. "But if you can integrate a neighborhood facility for cooling medicines, the picture changes. You are in effect squaring your sustainability gains. Identifying such opportunities implies really good communication, especially where several organizations or ministries are involved."

"A transition process can succeed only if everyone says, 'We are going to address this challenge together' " – Joep Offerman

Innovation

A third driver for transition is innovation. "You need new technologies take make transition possible," asserts Offerman. "The birthplace of a new technology is often a research project supported by national or international government, in which a consortium of businesses and knowledge centers work together on a promising concept, such as the use of membranes to extract water or CO_2 from flue gas. The role of initiator/coordinator of this kind of project suits us well, because our expertise provides a basis for communicating effectively with everyone."

Messenger boy

KEMA has a good starting position for assuming a catalyzing role in the transition process. Playing that role properly means not only accelerating developments, but also cooling things down where circumstances dictate. "As a consultant and messenger boy, we can bring people together. We speak everyone's language, enabling us to reinforce critical links in the chain," says Offerman. "We also have a wealth of knowledge. We understand the technological innovation process, we are familiar with all the rules and regulations and we have an eye for the commercial opportunities and implications for our clients."
"There is often overlap in various areas," adds Pfeiffer. "A power plant doesn't only generate electricity. It is also a source of heat, water and CO_2, which can be collected, reused or stored. Integration is the key to profitability, and integration implies collaboration." **<<**

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Creating new business models

The biogas chain

A Dutch energy company wants to establish itself in the biogas chain and has set up a project to produce biogas from agricultural waste. First, materials are digested, then biogas from the digestion process is used to drive a CHP unit that supplies a greenhouse complex. The energy company is also interested in supplying biogas to the public gas network or selling it for use as transport biofuel. Such applications are possible only if purity levels can be improved and the quality guaranteed. And that is where KEMA comes in. First, the technical feasibility and economic viability of the total process are examined. We also identify and define the risks for the energy company. This is no small undertaking, because the entire chain from source to end user is new and various technical aspects still need to be clarified; what's more, it is not certain who will be responsible for which part of the chain or what the regulatory position will be.

As well as the energy company, the farmers, the licensing authority, the funding government agency, the digester and CHP unit suppliers, the gas network operator, the fuel company and a certifying body are involved. A business model sheds light on the process, showing who will act as initiator and contract manager, how each player's activities will mesh with the next, who will own the technology and who provides added value. Clarity regarding these matters is needed before any market player will be willing to get involved, even once the technical feasibility has been demonstrated.
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Integrating gas and electricity

The smart distribution chain

KEMA participates in a European demonstration project in which the integration of both electricity and gas grids into one smart grid will be demonstrated in a field test. In Hoogkerk near Groningen 70-100 devices such as gas-fired micro-CHP, heat pumps, smart appliances, electric vehicles and solar panels in about 30 households will be centrally controlled under normal operational circumstances to assess how the integration of distributed energy sources and smart appliances into the electricity grid can be supported.

The project takes three different stakeholders into account: prosumers (consumers capable of producing electricity), a distribution system operator and an electricity trader. The objective is to find an optimal control solution for the electricity consuming and producing devices while respecting all stakeholders interests as fair as possible in a liberalized energy market. The project also investigates how gas-fired devices (micro-CHP, condensating boilers) can be used to relieve 'pressure' on the electricity grid. <<

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Sharing the risks

Process industry chain

Companies active in the Dutch processing industries and their suppliers have established a center of competence NAP. The Energy Special Interest Group is keen to accelerate the implementation of innovative energy projects by setting up a platform on which every level of the column has a voice. Drawing on their technical expertise, a team of KEMA consultants

Photo: Arjan Zoomers

is coordinating the platform initiative, with the aim of getting demonstration projects off the ground in fields such as waste heat utilization and efficient appliances. The risks are to be borne by the entire chain, so that no one player is over-exposed. After a year, the top managers will decide whether to take things forward. This approach, which enables us to make sure that everyone remains involved, will add momentum to the innovation process. The platform is also developing a format for energy-focused tendering. Implementation of this format will ensure that energy issues carry more weight in the process of inviting and assessing tenders for major projects. <<

Developing innovative technologies

The Concentrated Solar Power chain

The challenges with solar energy is the availability of supply, which follows its own day-night rhythm, and specifically the insolation-rate for Northern European regions. This is a potential drawback for the economics of solar power, since the price of electricity is dictated by supply and demand. Typically most parts of the world where levels of insolation are high, population density and energy consumption are low. Besides, no infrastructure to transport and or export solar energy from these regions are available. Consequently, very little initiatives for solar power generation are undertaken in these regions.

KEMA coordinates a project that investigates the technical and economic feasibility of importing solar energy from a high insolation region, the Sahara, to the EU-region. In addition, the energy flows will be studied, including the losses and the various potential benefits of energy being available where and when it is required. To this end, the project will also consider the best logistic set-up for the transmission and the input of energy to the European electricity network. The harnessing method will be Concentrated Solar Power (CSP). The harnessed energy will be stored in a storage-material (e.g. metal-metal oxide cylce) ready for transportation to an energy recovery site connected to the European electricity grid. There, the stored energy can directly be recovered to electricity or thermal energy. The storage-metal will oxidize during the energy recovery process. The metal oxide is re-used at the CSP plant where it is regenerated into metal, producing oxygen as a by-product. The storage metal would be readily transported over large distances and there would be no 'self discharge' problems.
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Certifying the process

Chain of custody

The European certification scheme for sustainably produced biomass for energy purposes currently is being developed. NTA8081 is based on the Dutch standard NTA 8080. This Dutch standard is the most complete and leading standard in Europe in this area at this time and is based on the Cramer principles. Most likely, parts of it will be adopted by the EU government in developing a European standard.

KEMA is responsible for an independent and sound implementation of the new scheme. While we are not technically involved in the development, we are focusing on the reliability and soundness of the scheme. In the end, we want a standard with built-in integrity, based on reproducible measurements, tests and checks.

In order to increase the value and recognition of the scheme, KEMA is preparing itself for accreditation this year.

The basics
The scheme is based on the chain of custody: Farmer / producer and if necessary trader – processor – end user.

Each chain participant will be checked on specific issues related to sustainability. These issues center around six themes, the first three – greenhouse gas balance, competition with food and local applications of biomass and biodiversity – being specific for biomass. The latter three – environment, prosperity, welfare – concentrates on the 'triple P' of people, planet, and profit.

Photo: Fotostudio Alain Baars

Producers that pass all questions and complete a successful audit investigation will receive a sustainable biomass producing certificate.

Every sustainable production batch will be registered in a web portal. The next party in the chain of custody, the processor, will be able to check whether a sustainable biomass purchase is registered by a certified producer. The processor receives a certificate upon fulfillment of all conditions of the certification scheme. The processing plantwill register the biomass batch production while fulfilling the conditions of sustainability on the registration web portal.

Finally the energy company using the biomass will be audited by the certification body. The energy company also has to make an account of the greenhouse gas balance. With this green house gas balance, reliable evidence is obtained on the use of sustainably produced Biomass. <<