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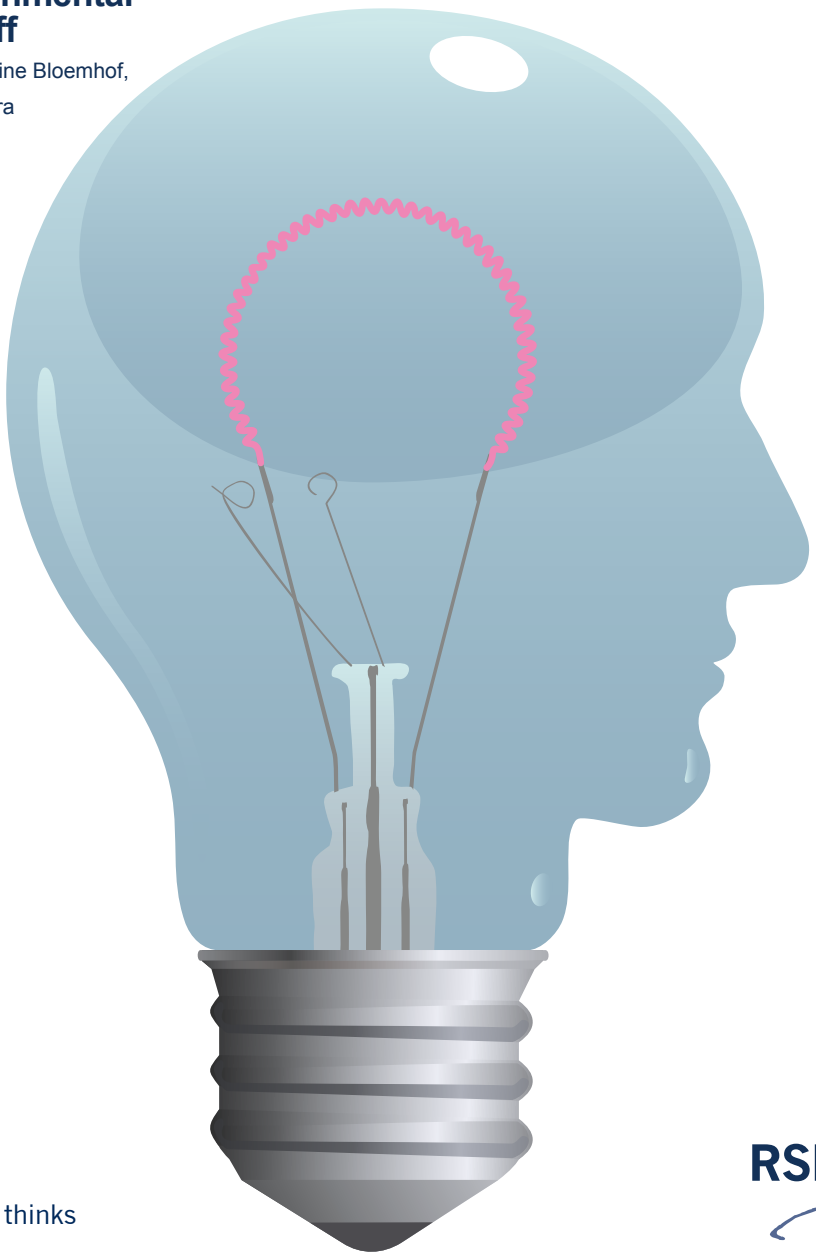


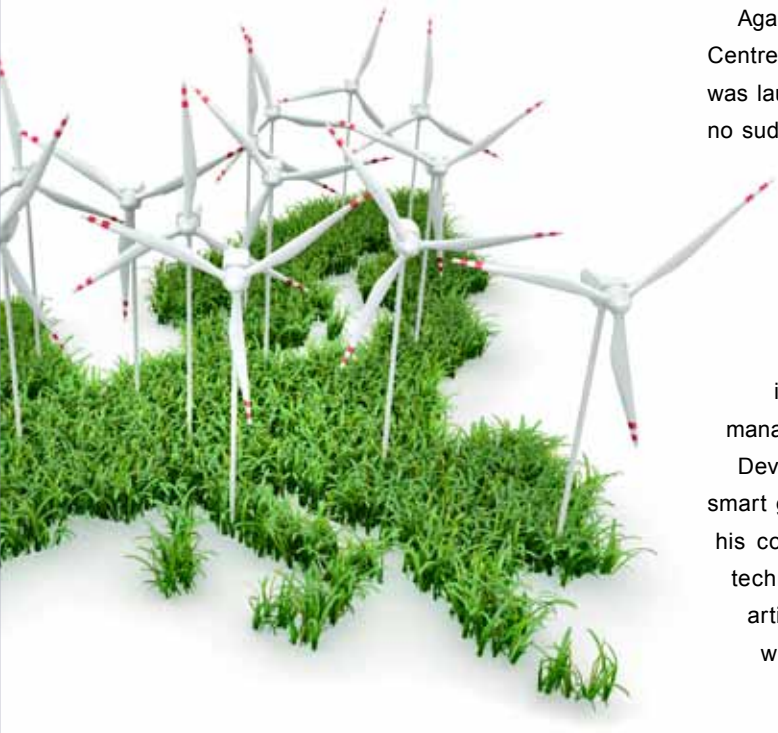
The business school that thinks and lives in the future

RSM Erasmus University

The future for energy markets

In discussion with Wolfgang Ketter

Governments, businesses and ordinary citizens alike face an increasingly challenging energy scenario – with rising populations in developing economies, demand is in danger of outstripping supply. To help find real solutions a new research centre, the Erasmus Centre for Future Energy Business, has been established.



Finite resources of fossil fuels mean that renewables such as wind, wave or solar power will become a bigger and more crucial part of the energy mix, yet these sources are inherently less predictable and harder to manage in terms of balancing supply and demand and ensuring systems that are robust, efficient and reliable.

Against this backdrop, the Erasmus Centre for Future Energy Business was launched last October. But it is no sudden departure: over the past five years the Learning Agents Research Group at Erasmus (LARGE), led by Scientific Director Wolfgang Ketter, has become one of the world's leading research labs in energy markets and their management.

Developing technologies for the smart grid of the future, Ketter and his colleagues are using complex techniques from computing and artificial intelligence to simulate what our future energy markets might look like, and understand more about the dynamics involved. They are also examining how domestic, industrial and commercial use of power needs to change, both to reduce overall consumption and to use available resources more efficiently.

The research is generating important insights for industry and for policy makers. 'As the California energy crisis in 2000 demonstrated, failures within the electricity supply system can have enormous consequences for people's lives and livelihoods. This makes policy-makers understandably reluctant to commit to new and untested market designs,' says Ketter.

'With the tools we are developing,' he continues, 'specifically our Power TAC platform, which uses a combination of modelling techniques and real-world data – you can simulate what might happen within the system under various circumstances. We can look, for example, at the effects of policy changes such as taxes and incentives, the impact of external shocks on the system's overall stability, or how rapid technological changes affect the infrastructure.'

Corporate funding

The work of both LARGE and the new centre has been attracting attention from a growing number of companies within Europe, and at the start of this

The future for energy markets (continued)

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year came the news that a multinational in the consumer electronics industry is to fund a major programme of work at RSM.

The substantial funding over the next four and a half years will support research and development at RSM in two main areas. A major part will go to the Erasmus Centre for Future Energy Business, financing several collaborative research projects between the company and the centre as well as providing a PhD post and other development costs. Further funding will be invested each year in the Power TAC platform, supporting researchers at both RSM and at the project's six core partner institutions across Europe and North America.

Ketter is very excited about the new possibilities that this collaboration opens up: 'Having this support from industry is a hugely important step forward for us. Our research goes from a fundamental level – into algorithms, information systems, artificial intelligence – right up to applied research, where we can feed back insights into real industry products.

'Because we have the capability to come up with specific new customer models that we can run, using real-world data from the company, we can generate "what if" scenarios for the future, using insights from that research to come up with solutions, expose new potential markets and help drive innovation. It's innovation that involves cross-fertilisation between academia and business and tight collaboration – exactly what a research-led school like RSM should be about. We have already received a large grant from the EU, but Sony is the first industry collaborator with whom we want to use our Power TAC environment in this way.'

Modelling future markets

Power TAC (Trading Agents Competition) is central to the work of LARGE and the project has been developed in partnership with research groups at leading schools around the world. The major partner within the project is the University of Minnesota, where John Collins, one of Ketter's long-term collaborators, leads the work.

The trading agents are pieces of intelligent software capable of autonomous decision-making. They are also known as learning agents because they have the capacity to learn and adapt to situations. Complex algorithms built in enable the agents to judge situations and reach decisions completely autonomously – in this instance, buying, selling and acting as brokers competing against one another within an energy market in order to derive maximum profits.

'They can do everything you would expect in a market: submitting bids, requesting quotes, negotiating deals and accepting offers,' says Ketter. 'They process information far faster than humans do, and their reactive capacity enables them to constantly monitor prices, set prices, and react instantaneously to market changes. They can function as a kind of personal assistant, helping us make better decisions – particularly in scenarios where information changes very rapidly.'

One such usage for these software agents will be employed is in the next generation of home energy management systems. More sophisticated than the current smart meters, these devices will enable certain appliances to be switched on when energy prices – determined by how much supply is available within the system – are most advantageous for the consumer.

'The idea of the smart grid is to expose energy users to the real costs of electricity,' explains Ketter. 'Currently most tariffs are either flat or two-part tariffs where people have little incentive to change their behaviour. But with dynamic pricing, there's a chance to incentivise people to become more efficient in how they use energy – and ideally to shift their pattern of usage to when those renewable resources are available.'

The Power TAC platform offers a great deal of flexibility – with the potential to incorporate many different types of consumer or producer models in the future, and play through different scenarios. Moreover, although Power TAC's explicit focus is on energy management, the fundamental techniques being developed have many other potential applications, Ketter says. 'Many of the ideas are not necessarily domain-dependent. The best algorithms can also apply outside energy management.'

Some algorithms from a similar agent-based simulation, this one focusing on supply chain management, have already been adopted by companies such as SAP, Ford and Daimler for use in their own operations. Flora Holland is also funding work by the LARGE group in which intelligent agents are used to support improved decision-making at the international auction centres it operates in Aalsmeer.

This summer, at the International Joint Conference of Autonomous Agents and Multi-Agent Systems (AAMAS) in Valencia in early June, the Power TAC competition will run for the first time on a completely open basis. Some 30-40 international teams from industry and academia will pit their agents against one another, then share results so that all can learn from the process and the underlying algorithms can be refined. Team-based competitions of this kind are, Ketter believes, a huge spur to creativity – advancing thinking in ways that could never be achieved within a single research lab.

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The initial findings and insights from the competition will be shared with a wider audience as part of the first Erasmus Energy Market Forum to be held in Rotterdam on 15 June. At this special event, designed to become an important annual forum for networking, leaders from industry, academia and policy-making bodies will come together to debate the opportunities and challenges offered by smart energy. ■

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RSM Expertise

More information about the work of the Erasmus Centre for Future Energy Business is available at the Centre's website: www.erim.nl/energy
For further details of Power TAC, see the project website: www.powertac.org/
Information about the LARGE group is available at: www.large.rsm.nl.

Rotterdam School of Management, Erasmus University

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Erasmus Research Institute of Management

ERIM is the joint research institute of Rotterdam School of Management, Erasmus University and Erasmus School of Economics (ESE) at Erasmus University Rotterdam. Within ERIM, over three hundred senior researchers and doctoral students are active in a diverse range of research programmes. From a variety of academic backgrounds and expertise, the ERIM community is united in striving for excellence and works at the forefront of creating new business knowledge.

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