

# Industry 5G – Not Just Dreams of the Future Due to Mathematics Expertise



*Dr. Paulo Renato da Costa Mendes brings 5G and Industry 4.0 closer together in his team; especially when it comes to the topic of flexibility and renewable energies.*

Slogans such as the Internet of Things (IoT) or Industry 4.0 are ubiquitous in the media. It seems clear that in the future, more and more machines, systems and devices will be networked with each other, especially in production. Everyone is also talking about 5G, which is considered the successor to 4G (LTE). But the fifth generation is much more than just a new mobile communications standard. 5G is opening up entirely new perspectives for Industry 4.0 as it is aimed specifically at communication between machines. The “5Gain” project, funded by the Federal Ministry for Economic Affairs and Energy, forms a core of the ITWM activities on the topic of 5G.

The team led by Dr. Paulo Renato da Costa Mendes and Dr. Christian Salzig is dealing with very practical problems and Industry 4.0 in the field of energy, more specifically with “5G infrastructures for cellular energy systems using artificial intelligence”. In the interview, Paulo Renato da Costa Mendes explains to us what the 5G developments mean:

**5G is considered a future technology par excellence. Siemens and Handelsblatt are already talking about “In-**

**dustrial 5G”. What advantages will 5G bring in the area of Industry 4.0? And when is that even foreseeable?**

5G is considered to be ten to 20 times faster than 4G, as well as more flexible, autonomous, secure and efficient. It enables higher data transmission rates and shorter latencies. Depending on the application, the advantages cannot be fully exploited simultaneously in one and the same network. The consumer sector may need rather high data rates to stream videos on the go, for example.

For industrial applications, reliability and lowest latency are important. Particularly where the level of industrial automation is already high, 5G offers rapid opportunities to turn Industry 4.0 into Industrial 5G. 5G is still largely a pipe dream. But we are talking about a relatively near future. In three to five years, some things will be realistically feasible.

### How can mathematics, or we at Fraunhofer ITWM, support this in practice? What challenges arise in the project and what expertise do we bring to the table?

Especially our years of experience and methodological competences in the field of machine learning qualify us. We develop AI algorithms for a wide variety of areas. This paves the way for optimally exploiting the potential for 5G. In the "5Gain" project, this helps when coupled with our project experience in the monitoring and control of energy networks. AI methods for the distributed control of cellular energy systems are just as much in demand as forecasting models. These are to predict communication requirements based on demand. The solution path is mathematics with the goal of developing intelligent grid control.

It can be explained more precisely like this: Due to the decentralized expansion of renewable energy sources with controllable loads and storage (e.g. electric mobility), the control of energy systems is becoming increasingly complex. Most electricity from renewables is weather-dependent. It is produced independently of demand, when the wind blows or the sun shines. More flexible thinking is needed. At the same time, the power grid should be ex-

panded as little as possible. Our solution approach: dividing the energy grid into regional cells. Each cell has different participants and characteristics and performs decentralized load management, feed-in management and marketing. We develop adaptive methods (e.g. reinforcement learning) that learn the control of such individually present energy grids.

### That means AI and machine learning are used. And what does that mean for 5G in the end?

The regulation requires a communications infrastructure that provides the necessary data rates, response times and resources for different numbers of participants, and does so flexibly and quickly in every situation. All this lies dormant in the advantages of 5G. We are working on the further development of various system components and testing them with our partners, also in real environments. For example, in the real lab of the city of Dortmund and with partners from the consumer side or energy producers.

However, other areas in which 5G creates completely new opportunities are of course also exciting. Another application example in the near future could be the remote maintenance of plants via 5G networks, so that 5G will also play an important role in our predictive maintenance application field in the future. There will certainly be other exciting projects to research and develop in the future.

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