

Creating a long-lasting platform to map the future of energy

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Credit: EMB3Rs

As energy costs sky-rocket and industries struggle to survive, [EMB3Rs](#) can make a difference. Austria-based researchers reveal how the platform is set to help companies cost-effectively convert waste heat to a valuable revenue stream, now and for many years to come.

How do you create a [digital platform](#) that can unite the providers and potential users of waste heat on a local and national scale while delivering meaningful data on network price and efficiency now, and well into the future? This is a question that researchers from Vienna-based energy economics start-up, e-think [energy research](#), and Technische Universität Wien (TU Wien) have answered while developing the EMB3Rs platform.

Designed to match waste heat providers and end-users, the platform maps the supply and demand of thermal energy from potential stakeholders and determines the cheapest option to connect potential users. The platform will show how excess heat and cold can be re-used as a valuable energy source for other industrial processes, district heating and other applications.

Ali Kök from the TU Wien's Energy Economics Group and Marcus Hummel of e-think have worked together to define the requirements and specifications of the EMB3Rs platform. In the words of Hummel, "this was an intensive process, and certainly wasn't a straightforward task." But as the project nears its end, both Kök and Hummel are confident their perseverance has paid off, and will do for many years yet.

Going the distance

EMB3Rs includes several open-source software modules that have been programmed to handle a huge range of energy-related technical and [economic data](#). For example, a business module assesses risk in an energy set-up, a techno-economic optimization module determines the least-cost option for using excess thermal energy across a supply chain and a market module calculates potential prices of waste heat in different market settings.

Ali Kök and colleagues at TU Wien have been developing the platform's all-important GIS module. This is critical for finding the most cost-effective way to connect heat/cold sources and sinks, and considers the options for reusing waste heat/cold at a certain distance from a district heating and cooling system.

As part of its calculations, the GIS module determines the distance between the source and sink, designs a potential network solution, and then works out that network's necessary grid investment costs and associated heat/cold losses. These calculations demand diverse data—examples include pump, pipe and digging costs, ground temperatures and water heat capacity, and the location of accessible roads.

According to Kök, he and colleagues retrieved data from user information and worked closely with ADENE—Agência para Energia—in Portugal. Here, ADENE's databases of Energy Performance Certificates (EPC) of Portuguese Buildings and of Industry Audits were instrumental to locating potential heat/cold sinks and sources and determining network solutions at both a local and national level.

The researchers also downloaded the all-important road network data from the free and open source roadmap database OpenStreetMap. "[Our

GIS module] uses data from this geographic database to create, say, the shortest district heating grid," explains Kök.

Scaling matters

Importantly, throughout GIS module development, scalability was at the forefront of the Kök's and his colleagues' minds. As Kök points out, "In some cases you may be modeling small areas with a small number of heat sources and users but you may also want to model at a large regional level, such as part of a large city."

To ensure the EMB3Rs platform easily scales from local to national levels, the researchers have designed the GIS module to lower the resolution of its networks as the area being modeled grows. Crucially, this also ensures the module's calculation times remain relatively short when devising a network across a large area.

"If the user is making a national assessment, [the module] cannot use all of the roads across an entire country as calculation times will take forever," says Kök. "So based on the complexity of an area, we remove the detail and lower the resolution of the network to ensure scalability." For example, the module will remove bike lanes and footpaths from its calculations as it scales up.

"Getting the right trade-off between detail and scalability has been a key challenge but we have managed it," he adds. "Our aim has been to use EMB3Rs in very small case studies, but we may also want to use it at a national level."

The complexities of module design, and integration to the platform, cannot be lost on any audience—indeed, both e-think and TUWien have coordinated the tricky process of defining [module](#) and platform requirements, in line with all user needs. Still, following years of

development, Hummel is certain the benefits of EMB3Rs will be long-lasting.

As he highlights, the platform can deliver nuanced and detailed "street-level" data, which makes it a very useful pre-feasibility tool for planning and designing energy solutions. "Digital tools are becoming more and more important—as more detailed data is generated, it needs to be analyzed and we need tools to do this," he says.

"We have found that it can be quite hard to keep the development of open-source tools alive... but I think it will be different for a pre-feasibility tool such as EMB3Rs as the information the platform provides can be taken directly to decision-makers and actually be used in project development," he adds. "Given this, I think there is a real chance of EMB3Rs being a really long living project that users will also pay for."

Lasting impact

So as the EMB3Rs project draws to a close, what impact will the platform have on the world's growing energy issues? For Hummel, the answer lies not only in having longevity to make a difference, but also education. He believes EMB3Rs has a real opportunity to show industries that generate waste heat how it can be used to create a potential income stream, especially in district heating systems.

"Because waste heat is at the end of the pipe, it's also at the end of many industries' thoughts, but with EMB3Rs, we can demonstrate the value of waste heat," he says.

"For example, EMB3Rs can show how the price that you get for supplying waste heat to a district heating system will depend on how much heat you have, how regularly you have it, the demand and the

other supply options in the network," he adds. "I've seen several unfavorable waste heat contracts, but that's due to the fact that companies just don't know how much money they should be getting for it."

Kök agrees, and reckons the EMB3Rs [platform](#) has arrived at just the right time. "I recently attended a scientific conference that focused on [district heating](#), and here we heard how some companies have survived high energy prices by selling their waste heat," he says. "So already today's energy crisis is motivating companies to look at how they can make revenue from integrating [waste heat](#) into energy systems."

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