QARNOT
USE CASES

Leilac
Numerical Simulations

DECARBONISING CEMENT AND LIME WITH QARNOT'S CLOUD COMPUTING SERVICES

The project's technical essentials

INDUSTRY
Numerical Simulations (CFD, Combustion)

SOFTWARE
Ansys Fluent

HARDWARE
128 cores cluster, Dual Intel Xeon, RoCE interconnect

CHALLENGES
Scale a simulation on hundreds of cores

CARBON FACTS
Energy and carbon footprint savings detailed report

Carbon Facts

Name	**Leilac's annual carbon facts**
Duration	**365d**
Saved Carbon Footprint	**5.71** TCO_2e
Saved carbon footprint %	**83.5** %
Energy	
Total consumed energy	**21.69** MWh
PUE (Power Usage Effectiveness)	**1.157**
ERE (Energy Reuse Effectiveness)	**1.16**
Carbon	
Qarnot carbon footprint	**1.13** TCO_2e
Equivalent European data center carbon footprint	**6.83** TCO_2e
Saved carbon footprint | compute + heat services	**5.71** TCO_2e
Saved carbon footprint %	**83.5** %
Water	
WUE (Water Usage Effectiveness)	**0** L / kWh

> "A wonderful thing about developing a new, promising industrial technology is being able to choose core partners that share your values, and we struck gold with Qarnot. Like us, Qarnot is mission-driven. It has a unique IT infrastructure distributed across Europe, which provides green cloud computing services that reuse heat released by their servers"

Vincenzo Panebianco
CFD & Combustion Development Engineer at Leilac Ltd

Why did Leilac select Qarnot as its provider of its large-scale computing services?

Performing CFD simulations at industrial scale requires considerable time and storage if a standard workstation is used, but computations can be scaled down if multiple cores are used in parallel. The only practical way to run these kinds of high quality CFD investigations in a reasonable timeframe is using high-performance computing resources from a company like Qarnot.

Access scalable computing resources

Creating massive computing clusters brings its unique challenges, as bottlenecks may appear which will slow down the simulation speedup. Qarnot's unique software and hardware expertise helped us choose the perfect configuration depending on the simulation size and the time restrictions.

Easy management of usage and costs

By using Qarnot, we have access to multiple licensing options, which can be chosen depending on the current need, including bring your own license (BYOL), hosted on the cloud or on-demand with elastic core scaling.

Providing dedicated support

Qarnot's engineers are committed to understanding our needs, ensuring prompt and responsive support.

Reducing the carbon footprint of IT workloads

Qarnot reduces the energy needed to cool its machines through the re-use of waste heat to provide large-scale site with significant heat needs and reduces the carbon footprint of IT workloads by 80%. In this way, Leilac and Qarnot are working together to reduce the environmental impact of our activities.

Computational Fluid Dynamics: why it's essential?

Leilac's decarbonisation technology is centred around the use of heat to separate and capture carbon dioxide (CO_2) emissions from limestone, which are an unavoidable result ofthe industrial process of making cement and lime. It's not a small thing. CO_2 emissions from cement are estimated to be between 6-8% of annual worldwide emissions, with a little over 1% more coming from lime.

To make our technology work, we need to perform complex simulations, using Computational Fluid Dynamics (CFD) to ensure that heat is used efficiently and responsibly at both smaller and lager industrial scales. High quality CFD analysis allows us to "look inside" our kilns, and deeply understand how heat behaves.

It's complicated because many factors influence the way limestone reactions happen, such as temperature and pressure, flue gas composition, exchanging surface areas, and fuel choice. It is almost impossible to watch the actual reaction taking place inside an extremely hot kiln, which is why this process is so fascinating and almost magical. Thus, it's this "magic" that our combustion and cement experts are trying to understand by using powerful simulation tools like CFD.

The Company

Leilac is accelerating a just transition to net zero by providing the most compelling decarbonization solution for global cement and lime industry.

Leilac's kiln technology efficiently separates unavoidable carbon emissions ready for use orstorage, without additional chemicals or processes. It is designed to be scalable, retrofittable, energy agnostic and electrification ready, providing flexible and economical pathways to carbon free cement and lime.

We also work with Heirloom, a direct air capture (DAC) company that is permanently removing carbon dioxide (CO_2) from the atmosphere, to deploy Leilac's renewably powered electric kilns at future Heirloom DAC facilities.

Heirloom will use Leilac's technology to heat limestone to produce high purity CO_2, which will go for permanent storage, and calcium oxide, which will be used in a novel carbonation process to directly capture CO_2 from the air and reform limestone. After binding and removing CO_2 from the air, the reformed limestone is fed back into the Leilac kiln, where the CO_2 is separated and captured, and the cycle begins again.

The CO_2 removed from the air will be mineralised, where it is bound to rocks or other materials, or injected underground into existing natural geological structures, where it remains safely and permanently stored. The integrated Heirloom and Leilac DAC solution will be 100% renewably powered to deliver the maximum net reduction of atmospheric CO_2.

Learn more about Leilac at www.leilac.com

Leilac-1, our pilot project at Heidelberg Materials' cement plant in Lixhe, Belgium