Project Partners

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Interdisciplinary Center for Scientific Computing (IWR)
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www.emcl.uni-hd.de
Germany

High Performance Computing and Architectures Group
Universitat Jaume I de Castellon
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Spain

IBM Research - Zurich
www.zurich.ibm.com
Switzerland

Institute for Meteorology and Climate Research
Karlsruhe Institute of Technology (KIT)
www.imk-tro.kit.edu
Germany

Scientific Computing Group
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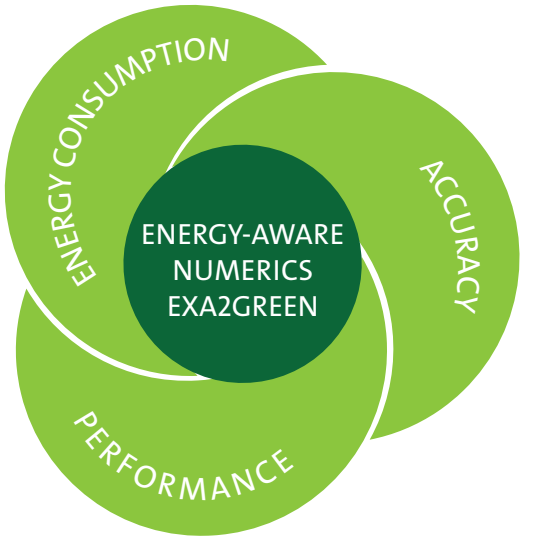
Steinbeis-Europa-Zentrum
www.steinbeis-europa.de
Germany

Swiss Federal Institute of Technology Zurich
Swiss National Supercomputing Centre
www.cscs.ch
Switzerland



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For further information on Exa2Green please visit
www.exa2green.eu

Exa2Green
energy-aware numerics

Energy-aware Sustainable Computing on Future Technology Paving the Road to Exascale Computing

Exa2Green is co-financed by the European Commission under the 7th Framework Programme

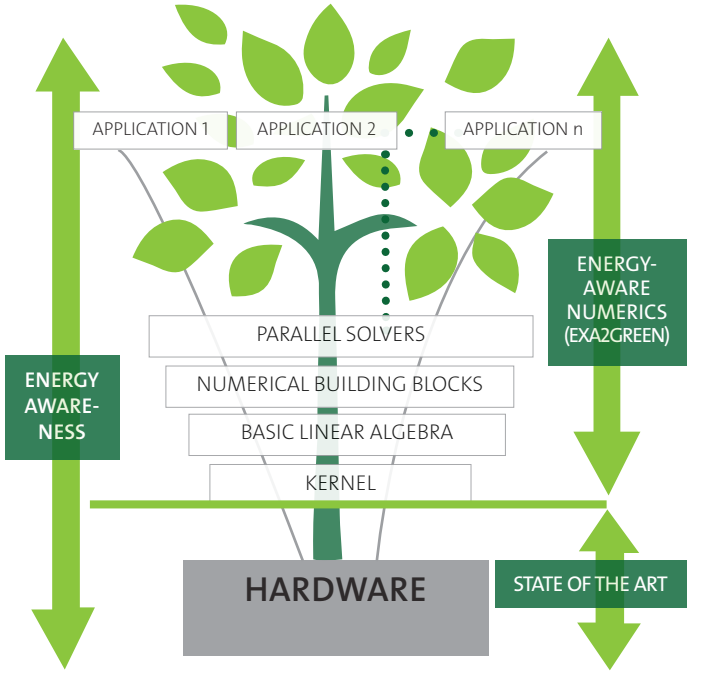
Vision

Caught between the continuous technological advances towards exascale computation and the global efforts for greener IT, power consumption of modern High Performance Computing (HPC) systems has become the major challenge on the road to exascale computing. The prospect of exascale machines finally enabling the quantification of uncertainties related to multi-scale modelling and simulation inevitably leads to the imperative need to reduce the prohibitive energy requirements of HPC systems.

However, as the current efforts towards an efficient reduction of energy consumption mainly focus on reengineering facility and hardware, the great potential of transforming and completely redesigning algorithms implemented in the applications on HPC systems remain so far unexplored.

Mission

In the Exa2Green project, an interdisciplinary research team of HPC experts, computer scientists, mathematicians, physicists and engineers takes up the challenge to develop a radically new energy-aware computing paradigm and programming methodology for exascale computing. As a proof of concept, the online coupled model system COSMO-ART, that is based on the operational weather forecast model of the COSMO Consortium (www.cosmo-model.org) is being modified to incorporate energy-aware numerics. COSMO-ART was developed at KIT and allows the treatment of primary and secondary aerosols and their impact on radiation and clouds.



The concept of energy-aware numerics is a multi-level approach in which all layers from kernels, numerical building blocks to application level are designed by means of an optimized trade-off between energy consumption, performance and accuracy.

Objectives

- Develop new multi-objective metrics for quantitative assessment and analysis of the energy profile of algorithms.
- Develop an advanced and detailed power consumption monitoring and profiling.
- Develop new smart algorithms using energy-efficient software models.
- Design a smart, power-aware scheduling technology for High Performance Clusters.
- Conduct a proof of concept using the COSMO-ART forecast model for aerosols and reactive trace gases.

Key Impacts

- Power-aware kernels for energy-efficient HPC.
- Power-aware linear algebra libraries for energy-efficient HPC.
- Linear system solvers optimized for energy consumption on the respective hardware platforms.
- Energy-optimized aerosol chemistry packages.