University of BRISTOL

Energy Aware COmputing (EACO) research at the UNIVERSITY OF BRISTOL includes both Computer Science and Electronic Engineering, with significant cross-departmental expertise and collaboration in energy monitoring and modelling, static analysis and compilers, processor architectures and embedded multi-core system design.

The EACO Workshop series at the University of Bristol brings together academia and industry to identify and address intellectual challenges in Energy Aware Computing with the aim to reduce the energy consumption of computation. Topics of EACO Workshops span the entire system stack from application software and algorithms, via programming languages, compilers, operating systems, instruction sets and micro architectures to the design of hardware.

University of Bristol contact: Kerstin Eder

University of Glasgow

The UNIVERSITY OF GLASGOW's James Watt Nanofabrication Centre use micro- and nano-technology research and manufacturing facilities to develop technology including Terahertz optics and Silicon nano-wires, healthcare applications and energy harvesting.

The Centre coordinates the Generate Renewable Energy Efficiently using Nanofabricated Silicon (GREEN Silicon) project, where the Seebeck effect is used to produce thermoelectric generators using Si/SiGe heterolayer technology, resulting in more efficient energy harvesting.

University of Glasgow contact: Douglas Paul

Tyndall National Institute

TYNDALL NATIONAL INSTITUTE is one of Europe's leading centres in ICT research and development. Applying an "atoms to systems" philosophy, energy research in Tyndall includes advanced concepts for low-power computing and efficient power supplies, energy storage and harvesting solutions, and technologies for wireless sensor networks applied to energy and resource optimisation in buildings and factories.

Tyndall coordinates a number of projects in the ICT-Energy field including the MANPOWER, SiNAPS, SQWIRE, PowerSWIPE and DEEPEN projects.

Tyndall National Institute contact: Giorgos Fagas

Coordinating research efforts towards

LOW ENERGY ICT

The goal of the ICT-Energy project is to create a coordination activity among researchers working on energy reduction in ICT from Nanoscale Devices to Exascale Computing.

By bringing together the **Toward Zero-Power ICT** community with the **MINECC** (MINimizing Energy Consumption of Computing) community this project enables a concerted effort to lower energy consumption across the ICT sector.

Our aim is to assess the impact of existing research efforts and propose measures to increase the visibility of ICT-Energy related initiatives to the scientific community, targeted industries and to the public at large through the exchange of information, dedicated networking events, education and media campaigns.

coordinator: Prof. **Luca Gammaitoni**
NiPS Laboratory, Dipartimento di Fisica
Università di Perugia
Via A. Pascoli, 1 - 06123 Perugia, Italy
telephone: +39-0755852733
fax: +39-0755848458
email: luca.gammaitoni@nipslab.org

www.ict-energy.eu

The UNIVERSITY OF PERUGIA's Noise in Physical Systems (NiPS) Lab studies the effects of fluctuations in electrical fields, heat, sound and other mediums. This has led to the development of novel energy harvesting and noise sensing devices.

The NiPS Laboratory coordinates the LANDAUER project where the operation of basic physical switches below the Landauer limit is studied to investigate conceptually new devices and novel computing paradigms with radically improved power efficiency.

University of Perugia contact: Luca Gammaitoni

ROSKILDE UNIVERSITY's Programming, Logic and Intelligent Systems (PLIS) group focus on the theoretical aspects of programming languages and their applications. PLIS has significant expertise in software verification, program analysis and transformation.

The PLIS group coordinates the Whole Systems Energy Transparency (ENTRA) project where advanced program analysis and energy modelling techniques are used to predict the energy consumption of programs early on during software development. This enables energy-aware software engineering.

contact: John Gallagher

The UNIVERSITY OF HEIDELBERG's Engineering Mathematics and Computing Lab (EMCL) applies numerical analysis to optimise the performance and energy consumption of High Performance Computing (HPC) as used in leading edge scientific programming.

The EMCL coordinates the EXA2GREEN project which aims to drastically reduce the energy consumed in HPC by developing advanced power consumption monitoring and profiling, and designing a smart, power-aware scheduling technology for HPC.

University of Heidelberg contact: Vincent Heuveline

At the HITACHI CAMBRIDGE LABORATORY (HCL) researchers investigate new designs of micro and optoelectronic devices, based on entirely new concepts, such as single electron logic circuits. Revolutionising the electronic devices used to power information technology has the potential to cut energy consumption by orders of magnitude.

HCL coordinates the Towards Low Power ICT (TOLOP) project which aims at the realization of novel low power devices (single electron transistors and single atom transistors), including implementation theory and the corresponding design architectures.

HCL contact: David Williams

BARCELONA SUPERCOMPUTING CENTER (BSC) uses HPC expertise to develop entirely new system-architecture models for low-energy HPC.

The BSC coordinates the Parallel Distributed Infrastructure for Minimization of Energy (ParaDIME) project where radical software-hardware co-design techniques are being developed that are driven by future device characteristics on one side, and by a programming model based on message passing on the other side. This approach is expected to yield dramatic energy savings in heterogeneous distributed systems.

BSC contact: Adrián Cristal Kestelman

AALBORG UNIVERSITY's Center for Embedded Software Systems (CISS) improve embedded systems development through the use of model-driven design tools. These allow designs to be written in a verifiable way, and analyzed for energy consumption and performance.

The CISS coordinates the Self Energy-Supporting Autonomous Computation (SENSATION) project which aims at increasing the scale of systems that are self-supporting by balancing energy harvesting and consumption. The research addresses the challenge of programming systems that reconfigure themselves in response to changing tasks, resources, errors and available energy.

Aalborg University contact: Kim Guldstrand Larsen

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE (EPFL) specialise in embedded and low-power systems, efficiently designed software algorithms and system level optimisations.

EPFL coordinates the PHIDIAS project which proposes the development of an ultra-low power smart bio-sensing wireless body sensor network, making use of new signal processing models and methods for efficient data handling. This enables long term low energy monitoring of bio-signals.

EPFL contact: Pierre Vandergheynst

www.ict-energy.eu