I.FAST

Innovation Fostering in Accelerator Science and Technology

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MILESTONE REPORT

Workshop on energy for sustainable science at research infrastructures, at ESRF

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ABSTRACT

The 2022 workshop Energy for Sustainable Science is the 6th workshop in a series and was held at ESRF in Grenoble. The workshop focuses on energy consumption, energy management and efficiency of research infrastructures in particular, but it also covers a wider context of sustainability and societal aspects. At the workshop best practices of RI's are reviewed and measures to improve sustainability are proposed. While many contributions were dealing with energy saving measures and intelligent energy management, the topics of using rare earth - and other critical materials, as well as sustainable live cycle management of components were addressed for the first time in this workshop series

For more information on IFAST, its partners and contributors please see https://ifast-project.eu/

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Delivery Slip

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Executive summary

The 2022 workshop Energy for Sustainable Science is the 6th workshop in a series and was held at ESRF in Grenoble. The workshop focuses on energy consumption, energy management and efficiency of research infrastructures in particular, but it also covers a wider context of sustainability and societal aspects. At the workshop best practices of RI's are reviewed and measures to improve sustainability are proposed. While many contributions were dealing with energy saving measures and intelligent energy management, the topics of using rare earth - and other critical materials, as well as sustainable live cycle management of components were addressed for the first time in this workshop series.

1 Introduction

The workshop series Energy for Sustainable Science was established with a first workshop organised by ESS in Lund, in 2011. This year's workshop is the 6th edition of the series and it was selected as one of the key events of 'Grenoble: European Green Capital 2022 to enhance Grenoble's engagement in sustainability.

Program and organization were established by an International Organising Committee with the members Carlo Bocchetta (ESS), Frederick Bordry (CERN), Serge Claudet (CERN), Andrew Harrison (ERF), Jean-Luc Revol (ESRF), Mike Seidel (PSI), Denise Voelker (DESY).

2 Content of the Workshop Program

The workshop program of two days contained two plenary sessions and in total four parallel sessions with titles: Energy efficient technologies; Energy management at research infrastructures (2 sessions one of which contained materials); and How will projects deal with energy and sustainability? The presentations are documented on an Indico page: https://indico.esrf.fr/event/2 .

The plenary sessions contained topics of general interest or applicability to a broader range of research infrastructures. On Thursday plenary presentations included: M.Jarraud: Climate change is moving fast. We need to move faster! Lucas Saludjian (RTE): (R)Evolution of the electrical system and its challenges.; Corentin GAUNAND and Bernadette REMENYI: Introduction to DemandSideFlexibility; Lincoln BLEVEANS (Stanford University): Energy management at Stanford University; and A. Hutton (Jefferson Lab): ERLs and Sustainability. On Friday the plenary sessions included: Summaries of the parallel sessions presented by Denise Völker, Mamad Eshraqi, Jean-Luc Revol and Serge Claudet. Other presentations included: Jean Paul BURNET (CERN): Energy management for the Future Circular Collider (FCC); Tadashi KOSEKI (J-PARC): Efforts to save energy consumption in KEK accelerator facilities; Hans-Jörg ECKOLDT, Wim LEEMANS (DESY): Advanced accelerator concepts and energy efficiency; Maurice BOURQUIN (TRANSMUTEX): Transmutation of Nuclear Waste with Accelerator-driven Systems; and Michael Krisch (ESRF): Extreme Brilliant Source (EBS): A new Light Source – first scientific highlights.

Most contributions were made by European institutions, but few speakers from Japan and the US presented as well. Two presentations in Thursday morning by Lucas Saludjian and Bernadette Renenyi gave a comprehensive description of the French electrical distribution network and revealed how important it is to ensure flexibility as well as economy at the laboratory level. We heard how large research centers like Stanford University (Lincoln Bleveans), KIT (Giovanni De Carne) or Darmstadt university (Christopher Ripp) are launching new initiatives to save and monitor energy consumption and to study alternative ideas in a real set-up. New projects like PIP-II (Tiffany Price), Petra IV (Denise Voelker), or the Linear collider (Steinar Stapnes) are implementing policies focused on energy efficiency and sustainability.

For accelerators the use of energy saving permanent magnets in compact light source lattices is a prominent topic, as well as the development of efficient RF power sources. Another trend in accelerators is the use of high temperature superconductors for magnets not only to achieve high field strength, but also for lower field strength for reasons of energy savings. Even the refurbishment of existing normal conducting magnets with superconducting coils seems feasible in some cases (presentation Lucio Rossi). In general many contributions presented new and technological solutions to tackle environmental problems. Not only energy consumption but waste water handling, general energy management solutions, live cycle of equipment used by science facilities.

Another topic mentioned in several contributions (Lincoln Bleveans; Christopher Ripp) was, that most Science facilities are made of a grown infrastructures and all Energy Management Problems have to take very old equipment and super modern state-of-the-art facilities under one umbrella. Solutions established here can benefit the whole society dealing with similar problems. Modernization programs as presented by D. Reinhard in Energy Optimizations Implemented at accelerators and infrastructures at PSI, can play a key role in reducing overall energy consumption and generating the same or even more science output from existing facilities.

Contributions like Rare earth and Life cycle management (D. Voelker) or A big science facility as a living-lab for energy transition (Frédéric Wurtz) connect the science facilities on a general basis to society and discuss negative environmental impact and positive influence on society in a much broader scale. Overall, being research facilities, large scale research infrastructure can contribute to discover, implement and test new technologies and policies for increasing sustainability.

Workshop Statistics

The workshop was held on a Thursday and Friday with a common conference dinner. To provide more presentation time, several sessions were held in parallel, beside the two plenary sessions for all participants. Each parallel session had a convener who presented a summary to all participants in the closing session. A total of 101 participants registered for the workshop. 32 talks were presented mostly in person, but a few over video connection.

Figure 1: Participants of the 2022 workshop of the Energy for Sustainable Science series, which was held at ESRF in Grenoble.

3 Summary and Conclusion

The ESSRI workshop series was organised with the support of European projects since 2011. Over these years it is clearly visible that the importance of energy efficiency and other sustainability aspects was continuously rising. At present the Covid crises and political conflicts have triggered an enormous inflation of energy cost, presenting another reason to undertake efforts at RI's in this direction. Practically all research institutions are working on measures to save energy and to plan future facilities carefully. The use of permanent magnets, HTS magnets and efficient RF sources including solid state sources are trends to be observed for new accelerator facilities. But also carbon footprint analysis, the use of critical materials, water consumption and life cycle management are important aspects.

The 2022 ESSRI workshop in Grenoble was organised with the support of the I.FAST program, and several contributions in the program are directly linked to I.FAST activities. The next edition will organized in 2024 by CIEMAT in Madrid, Spain.

Annex: Glossary

Acronym	Definition
ERL	Energy Recovery Linac
ESSRI	Energy for Sustainable Science at Research Infrastructures
RF	Radio Frequency
HTS	High Temperature Superconductor