

GENERA: How to Commonly Address Gender Equality in Physics

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Abstract Physics research may benefit from the greater presence of talented women at all levels, however, gender awareness and gender competences are not very much developed in this research field. In September 2015, 11 physics institutes and two professional support organizations started the EU-funded H2020 GENERA project with the motto “from physicists for physicists”. After having assessed the status quo, the GENERA consortium prepared tools necessary to tailor, design and implement Gender Equality Plans (GEPs) and measures in the participating institutions. In the GENERA toolbox, for example, more than 100 good practice measures to support gender equality in physics institutions have been compiled. Supported by research on careers in physics and guided by project internal evaluation, the physics institutions created and implemented their GEPs. The GENERA project officially concluded its original three-year run on 31 August 2018. During its lifetime, GENERA has boosted awareness on the issue of gender equity in physics. A series of Gender in Physics days – one-day national events invented by GENERA and organized by the project partners – was particularly helpful and demonstrated that commonly addressing gender equality in a network is beneficial for all. This is why the partners of GENERA were setting up the GENERA Network to continue with the original project’s activities after the end of the project, and to study the impact of GENERA on physics in the long run. Meanwhile, the GENERA Community of Practice has been created as part of the EU-funded ACT project to advance knowledge and collaborate in learning on gender equality.

Keywords Gender equality. Physics.

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1 Introduction

The GENERA (Gender Equality Network in the European Research Area) consortium has been formed to enhance gender equality in the field of physics research. Physics is a research field with a low representation of female researchers and a masculine image, and, this field, represented by different institutional actors, was targeted as the basis for GENERA analysis and interventions. GENERA brought together 34 Research Funding Organizations (RFOs), Research Performing Organizations (RPOs), and higher education institutions (HEIs) in the field of physics. The starting consortium carrying out the project was continuously extended during the three-year period to involve other interested major physics research organizations in European countries as associate partners or observers.

The GENERA consortium received funding from the European Commission under the call GRI.4.2014 “Support to research organization to implement gender equality plans”, within the Horizon 2020 Science with and for Society work programme. Its aim was to perform the following coordination and support actions with a focus on physics research and a keen eye on cultural differences throughout Europe:

- Assess the status of gender issues in the partner organizations.
- Identify gaps in existing Gender Equality Plans (GEPs) or activities and determine specific needs or actions to enhance gender equality and women careers in physics.
- Monitor and evaluate the existing activities of the involved organizations (partners and associates) to address gender issues.
- Formulate customized GEPs and create a roadmap for their implementation in physics, with the potential of application in other research fields.
- Support participating organizations in implementing customized GEPs.
- Create a network of RPOs, HEIs and RFOs that can continue promoting gender equality in physics after the project ends.
- Set up a long-term monitoring system allowing organizations monitoring the impact of their GEPs in physics with the potential of application in other research fields.

2 Gender in Physics – Assessing the Status Quo

Throughout the project, GENERA followed a “from physics for physics” approach considering (a) the characteristics of physics research as a field and (b) how physicists usually tackle a problem (take data, identify the problem and find a solution).

As a starting point GENERA carried out a comprehensive literature study to understand causes of gender inequality as well as to map and identify successful gender equality measures and conditions for improving research cultural environment in the fields linked to physics.

In summary, “the cause of gender inequality in physics – and in science in general – is a complex issue and cannot be based on a single factor. In a growing number of analysis of impediments to female scientific career, it has been demonstrated that gender imbalance in science results from an interplay of many institutional, social, cultural and individual factors. They include – but are not limited to – gender stereotypes and implicit biases, traditional image of an ideal scientist connected with the masculine nature of science, gendered understandings about supposedly ‘appropriate’ and ‘natural’ male and female interests introduced at the early age and continuing throughout adolescence and adulthood, unfavourable academic climate for female scientists (commonly referred to as a ‘chilly climate’), sex segregation of occupations, social norms of burdening women with excessive family responsibility for childcare, elderly care and household management, demands of full work-devotion within academia and STEM in particular, covert discrimination in the form of old boys’ networks, biased hiring practices, unfair distribution of resources, cultural perceptions of femininity and masculinity, bullying and harassment, as well as career preferences and lifestyle choices” (citation from the GENERA Report on how to improve the research cultural environment).¹

As a second step, many events to raise the awareness about the importance of gender equality were organized all over Europe. A concept for organizing Gender in Physics Days (GiPD) was developed in order to determine the current status of activities in participating countries oriented to promote gender equality in research, and gender equality plans in particular, focusing on cultural environments as well as identifying successful approaches and innovative ideas. The task of the GENERA organizations was to organize a tailored GiPD in their country. With the successful series of 10 GiPDs in total, more than 1,000 physicists and staff members became engaged in discussions about gender issues. The events were outstanding in promoting the importance of gender equality in physics. The GENERA project itself gained more visibility which helped the GENERA partners in their institution to design and implement GEPs. All stakeholders involved in gender equality were brought together to discuss jointly how to overcome gender imbalance and increase the involvement of men.

1 GENERA project, deliverable D2.2, report on how to improve the research cultural environment, 2016, <https://www.genera-network.eu/gip:howtoimproveresearchculture>.



Figure 1 Results of a workshop during a GIPD are presented and discussed with participants

For example, during the Italian GiPD, a school competition “Women in Physics: stereotypes and gender bias” was organized to address Youngsters and therefore the potential future generation of male and female physicists. The response was overwhelming, and the Italian GENERA partners received more than 100 hundred videos and articles from students. The winners of this competition were selected by a committee and awarded during the GiPD. The videos have been uploaded to YouTube.² Due to the success of this measure it was suggested to regularly repeat the school competition. The presentations and results of the GIPDs are available in the GENERA website.³

To analyze career paths and working conditions in physics, a study of interviews was carried out from 2016 till 2017. In total 83 semi-standardized and expert interviews were conducted with male and female physicists in research performing organizations, including both physics research institutes and physics departments of universities. The goal was to identify gender balance conditions in physics through assessing career paths of successful female and male physicists as well as the major challenges and obligations in their workday life, through evaluating the supporting and hindering conditions for their career progression.

One of the main findings was that career paths in physics are less linear and more shattered and precarious than they used to be in the past. Such new emerging career pathways bring more difficulties especially for scientists with care responsibilities and thus a need for a certain level of security. Most scientists working in physics have a great passion and satisfaction for their research. On the other hand, the non-permanent contracts, the need for being flexible and mobile,

2 GENERA project, Italian Gender in Physics Day school competition “Women in Physics: stereotypes and gender bias” videos, Italy, 2017, YouTube, https://www.youtube.com/channel/UCxZx0Cfc19g0HQqeQf2gIxg/videos?view=0&sort=dd&shelf_id=0.

3 GENERA project, results of the series of Gender in Physics Days, <https://genera-project.com/index.php/gender-in-physics-days>.

the amount of working hours and the general work overload create dissatisfaction. Furthermore, micro-aggression towards female researchers is a common experience.

The main findings from this study and recommendations for Gender Equality Plans in physics have been described in the GENERA summary report and guidelines of the interview results available in the GENERA website.⁴

3 Measuring, Monitoring and Evaluating the Progress

As previously mentioned, GENERA followed a “from physics for physics” approach taking into account the characteristics of physics research as a field such as being data-driven as well as acting on evidence. Therefore, GENERA decided to define a common framework for collecting gender relevant data in physics research organizations.

In order to develop this framework, many existing examples of gender equality plans or similar gender equality audits have been examined to identify which categories of data are commonly collected. Based on this information a data template was prepared that includes fields pertaining demographics, education qualification career path, work organization, and research output. GENERA partners have been provided with this data template to check the actual accessibility of gender related data in their organizations, while considering that many data, collected for different administrative purposes, may be, however, difficult to access (e.g. because of privacy issues) and thus to use and analyse in the project.

As a result of the data accessibility in the partner institutions, the standard GENERA Data Set has been defined as laid out in table 1. This data have been collected for the first time by the GENERA partners for year 2017. Figure 2 presents the share of male and female in the distinct career levels over all GENERA partners.

⁴ GENERA project, deliverable D2.3, summary report and guidelines of the interview results, 2018, <https://www.genera-network.eu/gip:generainterviews>.

Table 1 Description of the standard GENERA Data Set and the definition of the career levels

GENERA Data Set

	Variables
Work organization	Functions/units responsible for gender equality/diversity (with organizational chart)
Demographic Data	Gender (man, woman, other) Age (in 5-year steps)
Career Path	Staff x current level x gender (1 to 4 levels including early stage, for definition see following table)
Work status	Full time Part time Fixed position/Time bound contract

Career levels

	Short label	Definition
Level 1	Leading researcher/ Research Director/ Professor	Top researchers, full professors, research directors. This level includes the top management and organizations directors. Activities primarily focused on high level research and specialist teaching, including research project leading/ research and institutional policy orientation.
Level 2	Established researcher/ Senior scientist/ Assistant professor	Senior researchers/scientists/lecturers including research managers and research group leaders. Activities could include research management, research group coordination and teaching.
Level 3	Recognised Researcher/ Post doc/ Junior Academic	Researchers/scientists/lecturers and postdoctoral scientists. Activities primarily focused on research and on teaching and programme management. This is considered the basic level of the career development in the organizations.
Level 4	First stage researcher/ Research assistant/ Doctoral candidates	Research and project assistants/doctoral students/ research grant winners pre-doc, including any researcher without doctoral degree. Activities focused on supervised research and training. Frequently participating in a structured programme or working collaboratively in a larger team. They may have student status and/or be employed by the organizations. This is considered the entry level in the organization.

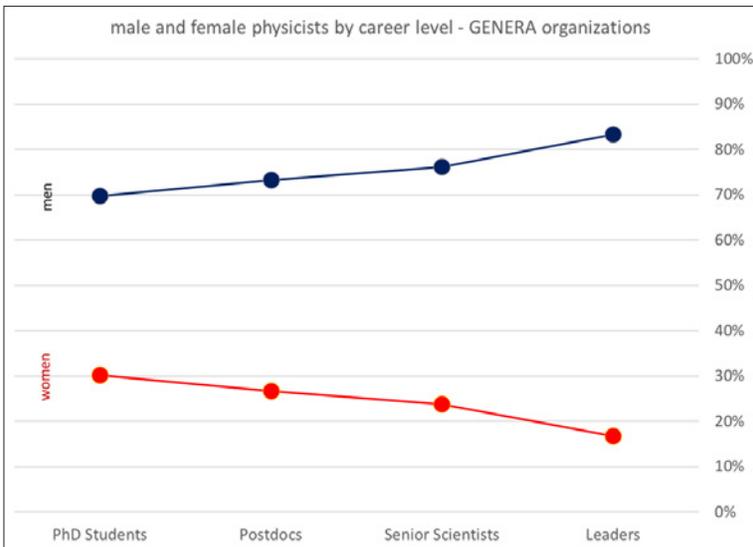


Figure 2 Male and female physicists by career level for all GENERA organizations, based on the information of 8,023 persons in 2017

Unsurprisingly, the plot demonstrates the lack of women in physics research in all career levels and their disappearance as they advance on their career (leaky pipeline effect). It is especially important for physics research organizations to increase the number of female PhD students entering the academic system (30% in GENERA organizations) entering the academic system. Activities with children, pupils and students like the GENERA school competition (chapter 2) are thus highly recommended.

The GENERA data set forms the basis of the long-term monitoring to be performed as part of the GENERA Network and Community of Practice. The second data collection round has been started in March 2019.

4 Customizing and Implementing Gender Equality Plans in Physics Institutions

The overarching goal of the GENERA project was to support partner organizations in tailoring Gender Equality Plans (GEPs) to their individual needs, to provide help in the implementation of the GEPs and to monitor and evaluate this process.

Each implementing partner had to nominate a so-called “Implementation Manager” (IM). It was the duty of the IMs to liaise with all relevant institutional stakeholders and prepare or supervise the

preparation of GEPs in the implementing partner organizations. The IMs were asked to keep the management of their institutions informed and take care of the GEP implementation process as described in the implementation roadmap. The group of IMs came together for a regular exchange on the progress of the implementation in the individual organizations. Critical success factors for the GENERA change agents (or IMs) were the following: knowing the organization as well as having prestige and power, being supported from the highest management level, having competences in organizational change processes, having gender and diversity competences on a theoretical and practical level as well as organizing themselves in a team or committee within the institution. Last but not least, being provided with the suitable amount of resources to avoid that e.g. especially women have less time for their research due of their involvement in (gender) projects.

An extensive review of available toolboxes and toolkits for gender equality measures was carried out to prepare the GEP implementation. It has shown that there is a tendency to argue that “this measure might help in social sciences; however, physics is different!”. After a careful discussion, the consortium decided to develop a toolbox for physicists by physicists with the focus on measures that (1) have been successfully implemented, (2) are systematically embedded in the institutional culture, (3) are sustainable, (4) are transferable to other disciplines and (4) ideally are innovative.

By the end of the project, the GENERA toolbox contained more than 100 gender equality supporting measures structured in six “fields of action” such as “structural integration of gender equality”, “engaging leadership”, “flexibility, “time and work life”, “presence and visibility”, “gender inclusive/sensitive organizational structure”, and “gender dimension in research and education” and addressing eight different target groups: management and leadership, administrative personnel, scientific personnel, professors, postdocs and mid-career scientific personnel, PhD students/candidates and research assistants, students (undergraduate and graduate), and pupils. The GENERA toolbox is designed as a living document and will enable implementing organizations to tailor GEPs specific to their individual needs. The toolbox describes in detail the implementation objectives of each measure, as well as the difficulty of its implementation, which is classified as “easy”, “advanced”, “well advanced”.

Inspired by the GEAR tool developed by the European Institute for Gender Equality (EIGE), a roadmap for implementing GEPs has been developed by GENERA. This step-by-step guide describes all the activities supporting the implementation of customized GEPs:

1. “learn”: understand the structure of the organization and its rules
2. “analyse”: analyse the state of affairs using gender indicators

3. “design”: design a tailored GEP, define specific aims and develop dedicated measures
4. “implement”: implement the GEP and its measures
5. “monitor and adjust”: monitor the progress and adjust the specific aims and measures
6. “final evaluation”: based on the results, adjust the GEP and move forward.

Having in mind that organizational change processes are far from being linear, the GENERA Roadmap helped to serve as a practical guidebook for the GENERA IMs throughout the entire implementation phase in the individual organizations. Training workshops thematically focused on the six roadmap topics have been organized for the IMs to enable exchange, mutual learning and empowerment as well as getting advice from the GENERA experts. Providing a strong support for the IMs was very important since change processes imply frustration and need patience, tolerance and persistence.

The accompanying project internal evaluation provided up to date information and knowledge about the status quo of implementation processes and, therefore, enabled to recognise activities where efforts were not realised, or were not effective and could be improved. Accompanying evaluation in this sense was a learning process, which supported the implementation activities and provided important information for modifications and adaptations.

As structural change processes are long-term efforts, the evaluation tried to assess the outputs, outcomes and impacts of measures for promoting gender equality in the partner organizations, providing also a monitoring tool therefore. The assessment of gender equality in the partner organizations – as part of the impartial evaluation performed by one project partner – has been advanced by the following three measures: first, a policy survey has been performed, to be aware and better prepared for a series of ex-ante interviews with important stakeholders of the institutions. This policy survey provided more information about the kind and scope of measures already implemented in the partners in GENERA. Second, fact sheets per partner organization have been developed out of the policy survey. Third, the series of ex-ante interviews with the GENERA partners has been prepared.

Target groups were specified, a guideline for interviews was developed and both were presented to the consortium. The different target groups were management, equality officers, HR leaders, local GENERA personnel including the implementation managers, female researchers and other relevant stakeholders. Partners were able to decide between face-to-face interviews at their premises or skype/phone interviews. The intention was to visit each at least once, either for the ex-ante assessment or the ex-post assessment.

Ex-post interviews were conducted near the project end. Throughout the project it became clear that the interviews not only had the function to gather data, but they also supported the processes within the partner organizations by providing a signal that gender in physics is on the European agenda and gave those involved the chance to talk about existing issues.

Driven by the limited project lifetime that mainly allowed to design and put GEPs in place, the project partners decided to develop an overall frame to monitor GEP progress – out of which each organization can choose measures and targets best fitting for their implementation work. The resulting PAM (Planning – Action – Monitoring) tool⁵ is not used to compare on a macro-level, but to monitor progress within a research organization. PAM allows users to find measures, indicators and targets for GEPs. The tool has been designed along the experiences that were made during the lifetime of GENERA. It is therefore a tool based on the experiences in physics organizations and it has been specifically conceptualized to monitor gender equality plans and measures in physics.

5 Networking and Establishing a Sustainable Structure

The GiPD events and all the other dissemination activities created a growing interest from institutions to join GENERA. Throughout the entire project lifetime, it was possible to extend the GENERA consortium by integrating additional physics and related institutions interested in GENERA project, who were granted observer status. Figure 3 shows the map of all 13 beneficiaries, 3 associates and 18 observers of the GENERA consortium as of August 31, 2018.

In contrast to the beneficiary organizations, whose work in the project was funded from the project grant and whose role was clearly defined and monitored, the observers could decide whether they only want to follow the project activities or get involved in the project tasks.

⁵ GENERA project, Planning – Action – Monitoring Tool, 2018, <https://www.genera-network.eu/pam:pam>.

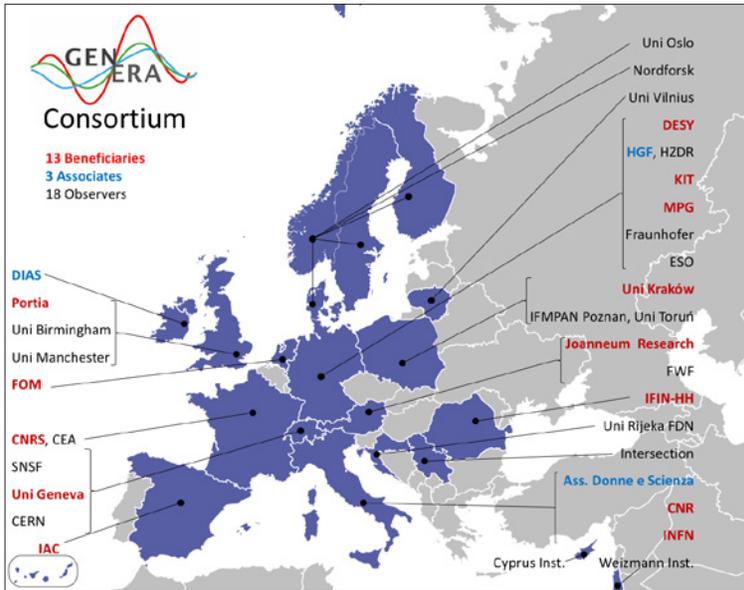


Figure 3 Extension of the GENERA consortium as of August 31, 2018

It was already defined in the GENERA project work program to plan and establish a sustainable structure (GENERA Network) responsible for a long-term monitoring, impact evaluation and consulting for future gender activities. To introduce GENERA achievements and plans for GENERA Network to the entire physics community in Europe, all 5,000 physics institutes and physics departments and faculties listed on the PhysNet website⁶ have been contacted and invited to two combined networking and policy briefing events.

⁶ List of European physics departments, PhysNet, <http://de.physnet.net/PhysNet/europe.html>.



Figure 4 Panel session during the second networking and policy briefing workshop with Gareth O’Neill (EuroDoc), Fabienne Gautier (Euraxess), Ana Arana Antelo (European Commission), and Cécile Gréboval (Council of Europe)

During the workshops many ideas were collected, that helped shaping the objectives and tasks to be addressed with GENERA Network. Based on this, the GENERA consortium prepared the GENERA Network Memorandum of Understanding (MoU).⁷ The MoU describes a lightweight structure with no financial or legal obligation, designed instead to establish firm commitment by the members to participate in the data collection and monitoring and improving gender equality in physics. At the GENERA final event on August 31, 2018 the GENERA Network was officially launched, having established the required minimum of five member organizations signing the MoU. Details about the GENERA Network consortium can be found on the GENERA Network website,⁸ in June 2019 GENERA Network comprised 26 member organizations and four organizations that received the Friends of GENERA status.

⁷ GENERA Network, Memorandum of Understanding, 2018, <https://www.genera-network.eu/mou>.

⁸ GENERA Network, consortium members, 2019, <https://www.genera-network.eu/network>.

6 Summary and Conclusion

The GENERA project was able to bring together major players in physics research in Europe to address gender equality in a cooperative way and sustain its activities by creating the GENERA Network. All the dissemination activities together have created a great visibility and helped establishing GENERA as a brand. The great interest in the physics community all over Europe and beyond confirmed the importance of the subject and that GENERA as a collaboration on gender equality at the European level had an impact on the strengthening of the gender dimension at the institutional level. It is assumed that in the coming years GENERA work may also affect national and European research programmes dedicated to physics research and beyond.

Tackling gender equality issues as a joint activity in a collaboration has been proven successful. It was quite helpful that physicists are used to work in larger cooperative environments when intellectual and material resources need to be pooled to build and maintain large research infrastructures and many countries must join forces.

The present status of activities in participating institutions oriented to promoting gender equality was assessed. Successful approaches and innovative ideas for gender equality measures have been incorporated in the GENERA toolbox and roadmap. By analysing existing GEPs, GENERA was able to identify missing elements and develop new features to complete the GENERA toolbox. With this toolbox all GENERA implementing partners and some of the GENERA observers were able to customize GEPs. The roadmap served as guidebook for the implementation of the GEPs.

The design and implementation of GEPs was accompanied by a professional internal monitoring and evaluation. All implementing partners received feedback and strong support on how they could improve their gender balance, identify gaps and suitability of recent gender actions, and how to continue the monitoring and evaluation beyond the lifetime of the project. The PAM (Planning - Action - Monitoring) tool was developed to monitor progress of gender equality.

The approach to have an impartial evaluator, a GENERA consortium partner, was effective, stimulating and helped to make the design and implementation a success. The GENERA “critical friend” (as the evaluator was named) served as a source of expertise and guidance to early communicate also potential difficulties.

By a consecutive extension of the GENERA consortium, during the project lifetime and with the founding GENERA Network at the end of the project, an European alliance of RPOs and RFOs responsible for a long-term monitoring, impact evaluation and consulting for future gender activities was established.

Several GENERA partners participate in the EU-funded ACT project, which shall build up so-called “Communities of Practice” (CoP)

to share knowledge on GEP implementation and related topics. GENERA Network will be forming one of the ACT CoPs. ACT will support GENERA Network to enable a knowledge transfer and sharing the evidence of the benefits of implementing gender equality plans and thus increase the number of RPOs and RFOs making use of GENERA achievements and implementing GEPs. Therefore, it can be assumed that, in the medium- and long-term, GENERA activities will contribute to the achievement of ERA by increasing the number of female researchers, improving their careers and mobility and thus contributing to research intensity. The existence of a GEP and good working conditions in a physics institution might become a selection criterion for researchers in Europe.

The tight bilateral or multilateral cooperation and communication between partners and individuals involved in GENERA is expected to last beyond the project lifetime. This will foster the overall impact of GENERA. Furthermore, some GENERA partners were able to organize a GiPD or a school competition again. It can be assumed that within GENERA Network GiPDs can be established as regular events.

The diversity of the GENERA consortium was immense in terms of sex, disciplines, researchers vs. practitioners, young researchers vs. professors, national backgrounds, languages, cultures of working together, different levels of gender competences and the amount of gender activities in the involved organizations. The positive effects of diverse teams are well proven (for example Catalyst. *Diversity Matters*. New York: Catalyst, October 1, 2014). However, making diversity accessible in teams is an additional task and the way to get there can be intense and complex. Success factors to create a fruitful and learning environment within the GENERA consortia was (a) focus on the similarities and (b) sharing the common vision of a diverse research culture with less gender discrimination. With doing so, GENERA has created a unique collaboration between physics and gender scientist supporting the GENERA community now and in the future to commonly address gender equality in physics.

References

- Website of the EU-funded H2020 project ACT, 2019, <https://act-on-gender.eu/>.
- GENERA project, deliverable D2.2, report on how to improve the research cultural environment, 2016, <https://www.genera-network.eu/gip:how-toimproveresearchculture>.
- GENERA project, Italian Gender in Physics Day school competition “Women in Physics: stereotypes and gender bias” videos, Italy, 2017, YouTube, https://www.youtube.com/channel/UCxZx0CFc19g0HQqeQf2gIXg/videos?view=0&sort=dd&shelf_id=0.
- GENERA project, results of the series of Gender in Physics Days, <https://genera-project.com/index.php/gender-in-physics-days>.
- GENERA project, deliverable D2.3, summary report and guidelines of the interview results, 2018, <https://www.genera-network.eu/gip:generainterviews>.
- GENERA project, Planning – Action – Monitoring Tool, 2018, <https://www.genera-network.eu/pam:pam>.
- List of European physics departments, PhysNet, <http://de.physnet.net/PhysNet/europe.html>.
- GENERA Network, Memorandum of Understanding, 2018, <https://www.genera-network.eu/mou>.
- GENERA Network, consortium members, 2019, <https://www.genera-network.eu/network>.

