

Europe's PV researchers stake future on the power of joined-up thinking

Ben Willis, Head of Content, Solar Media

ABSTRACT

Sophia, a four-year European Commission-funded project to promote coordination across the EU's PV research community came to an end in January. With 20 partners drawn from industry and academia, the project appears to have fulfilled its aims of fostering greater collaboration. But with Europe's PV manufacturing industry facing a dire predicament in the face of competition from Asia, is it too little, too late?

What does the future hold for European PV research and development when the continent's solar manufacturing industry appears to be in the final throes of being lost altogether to foreign competitors? This question was the proverbial elephant in the room during a two-day series of events held at France's national solar institute, INES, at the end of January 2015 to mark the winding up of the Sophia project, a four-year European Commission-funded programme to promote collaboration between the continent's many PV research establishments.

The occasion was a useful opportunity to reflect on what the project had achieved over its lifetime. But during an extensive briefing for journalists at INES followed the next day by a symposium for Sophia participants, the biggest topic for discussion was not so much how the project had pushed forward the state of the art in photovoltaic technology, rather how the continent's R&D community would continue to define its place in the world when Asia is fast emerging as the dominant force in PV manufacturing.

European R&D collaboration

Launched in 2011, Sophia was awarded a €9 million grant under a European Union funding programme aimed at improving Europe's research capabilities. Its founding principle was that although a lot of good work goes on across Europe's many PV research institutes, in an age of increasing competition, efforts to improve coordination and avoid duplication were increasingly crucial to maximise its impact.

"Coordination is a key issue for EU research in general, not just for PV, to avoid overlap between all the member states," said Philippe Malbranche, incoming director general of INES and the Sophia project coordinator. "Competition is fierce worldwide and there's no use to compete between European member states and not to do the maximum to be able to compete on the international scene."

Malbranche explained how the proposal for funding for Sophia to the EU sought to



The four-year Sophia project set out with the aim of improving coordination across Europe's PV research community.

Source: CEA-INES.

engender a spirit of collaboration across Europe's PV research community by gathering together as many of the relevant organisations in the field as possible: "If there were to be two competing proposals in this field, it would have meant that some partner would be against the other. So you have to show a real willingness to coordinate everybody."

Eventually, the project secured the participation of 20 partners – 17 research bodies and three industry associations. It set out with the aim of exploring eight main research topics, covering the whole PV value chain (see box for details of partners and research topics), through three main areas of activity: networking, encompassing workshops and webinars; so-called 'transnational access', which offered industry and research centres free-of-charge access to use 48 test platforms offered by the Sophia partners, covering the project's main research topics; and joint research activities.

The latter category took place under four main themes: quicker lifetime prediction of PV modules; greater accuracy of rated power and energy output prediction of PV modules and systems; improved PV material characterisation, covering c-Si, thin-film and organic solar cells; and better modelling of PV materials, cells and modules, as well the performance of the entire PV system. In total, 50

research projects were carried out under this strand of the programme.

Malbranche said the joining up of the research efforts of a number of previously disparate entities was one of the Sophia project's first big challenges, but ultimately one of its successes.

"For instance, when you measure a PV module, one centre is going to measure it every second, the other every five seconds, another one every 10 or 30 seconds. And then when you want to compare things, it's not so simple at all," Malbranche explained. "The way to go further with collaboration is to get trust and confidence in the figures that you get and the measurements you get from one side to another if you want to compare things. And maybe you are aimed at measuring the same thing but not using the same equipment, so you need to organise a round robin and check which equipment is quickest or the most accurate. You can learn a lot from just reviewing the data; first reviewing, then exchanging and then starting to work together on some specific issues in an organised and coordinated way."

The full breadth of the joint research activities that took place under the Sophia banner and the results they generated are beyond the scope of this article to summarise. Among the highlights, Malbranche and other stakeholder colleagues in the project cited the

transnational access component of Sophia as one of its great successes. The webinars too were flagged up as another of the project's highlights, in some cases attracting up to 250 viewers at a time for the more popular topics.

In terms of specific pieces of research, Malbranche pointed to the collaborative work the Sophia partners undertook in the area of accelerated ageing tests for modules as being particularly significant. "More and more you have PV modules that are passing the quality test, but which can present some defects two years after. That was not occurring so much in the past, but due to the fierce competition in which you are trying to reduce the amount of material you are trying to use in the PV module, it becomes more sensitive," he said.

"So we know the conventional test sequence which you use in the standard and we deliberately tested additional test sequences – or superimposing several constraints at the same time, which is not the case with the conventional standard. We have a complete test plan in which we tested 15 ways of degrading PV modules, not following the IEC test sequence."

Pressed on what else the project had specifically achieved in terms of advancing PV technology, Malbranche stressed that this was not the point of the project. "I understand the need of journalists to have big announcements, and for that the best thing would be to say we have developed a new cell and it has an efficiency of 25%, 45%, it's a world record, perfect. This was not at all the aim [of Sophia]. Measuring coordination is not very easy; it's little step by little step, people gradually getting to know each other."

European market difficulties

A further question that persistently arose concerned Sophia's relevance in the bigger-picture context of Europe's PV market. During the Sophia press conference, Malbranche voiced his frustration at the knock-on effect of the recent decline in the European solar market on the PV research community.

"The European market has been hit by the Asian competition, so the number of PV manufacturing companies in Europe has been decreasing a lot, which means that the equipment supplier industry is not in good shape. So that it makes at least European investors reluctant to invest [in new innovations]," he said. "If you don't have the market, then you don't have the industry, and you don't have anyone to pay for your research, even if you have some public funding."

The same issue had been graphically illustrated earlier that day during a tour of the INES laboratories, led by the institute's outgoing director general, Jean-Pierre Joly. After proudly showing off

SOPHIA partners and research topics

Partners:

CEA-INES
 Fraunhofer (ISE & IWES)
 ECN
 IMEC
 Joint Research Centre, European Commission
 HZB (Helmholtz Zentrum Berlin für Materialien und Energie)
 Jülich
 Risø DTU (Danmarks Tekniske Universitet)
 UPM
 ENEL (Agenzia Nazionale per le Nuove Tecnologie, l'Energie e lo Sviluppo Economico Sostenibile)
 CREST (Loughborough University)
 ENEA
 VTT
 SINTEF (Stiftelsen Sintef)
 Austrian Institute of Technology
 European Photovoltaic Industry Association
 EUREC (European Renewable Energy Centres Agency)
 TECNALIA (Fundacion Tecnalia Research & Innovation)
 DERLAB (European Distributed Energy Resources Laboratories)

Research topics:

Silicon material
 Thin films
 Organic PV
 Modelling
 Concentrating PV
 Building-integrated PV
 PV module lifetime
 PV module and system performance

one of the advanced heterojunction solar cell prototypes developed at INES, the question of where the cell was destined for was posed. “We need to find a big investor in Europe for this, but the market is not so good,” came Joly’s rueful response.

And the issue erupted with some force again the next day during the Sophia project’s valedictory symposium. Three representatives of Europe’s declining PV manufacturing industry – from toolmaker, Meyer Burger, from Photowatt, one of Europe’s few remaining integrated ingot, cell and module manufacturers, and from production system supplier, Manz – were invited to offer their views on the interplay between Europe’s declining solar manufacturing industry and its research and development operation. Their assessments were not encouraging.

Sylvère Leu, chief innovation officer at Meyer Burger, urged the R&D community to “wake up”, highlighting the “very, very tough” time equipment manufacturers were experiencing in the face of competition, primarily from China, where the domestic industry is sourcing more and more materials and equipment locally, effectively limiting China as a potential export market for European equipment specialists.

Leu said that for Europe to compete, it needed to build “gigawatts” of capacity to generate competitive economies of scale, meaning the R&D sector needed to produce innovation “that is ready to use”.

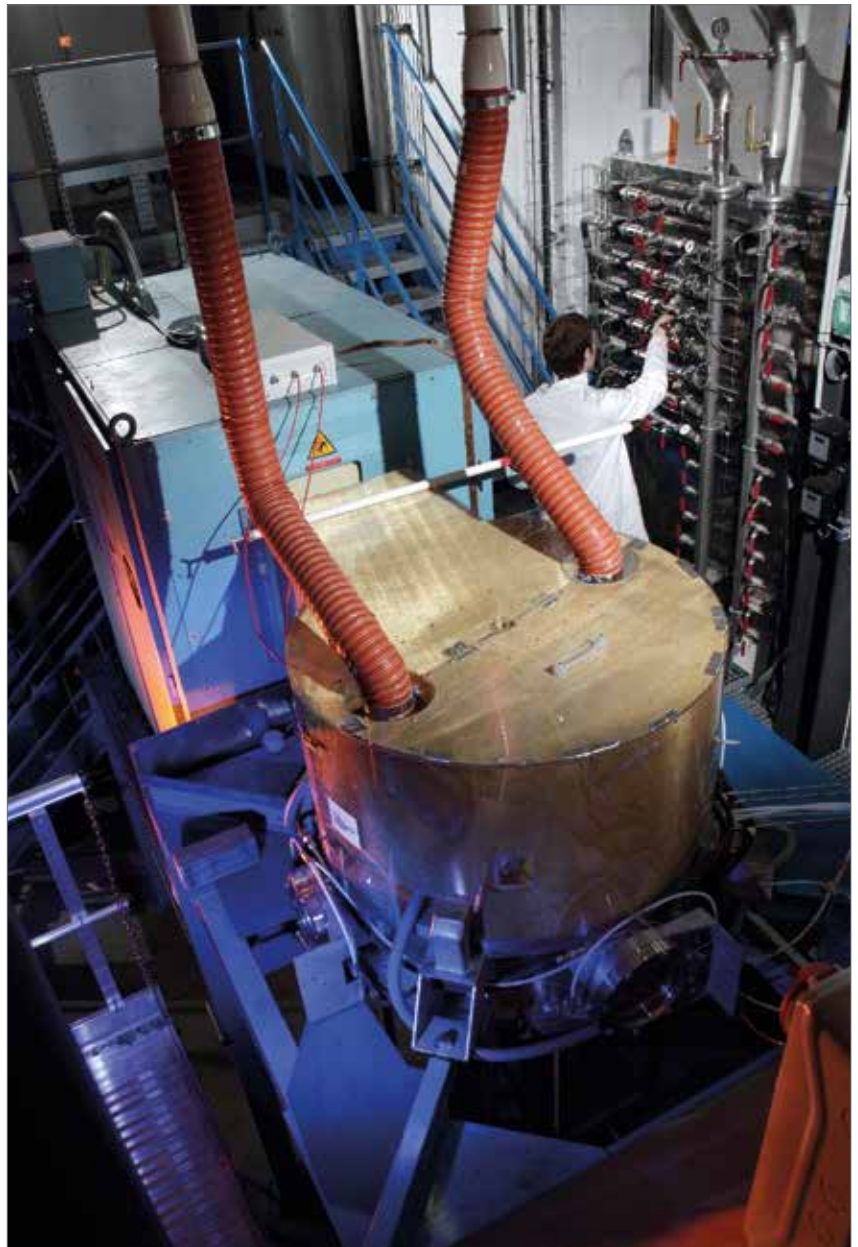
“This is the task. I invite you to fight with us in this hard environment. We have to wake up. I have seen here a lot of strategies, a lot of technologies, but we cannot implement such a lot of tools. We need one focus. There are a lot of ideas, but the problem is choosing one idea and making it happen – this is our requirement.”

Vincent Bes, chief executive of Photowatt, went a step further, warning the Sophia symposium audience that European R&D community needed “systemic” change in order to weather the storm from China. He even suggested a complete overhaul of the way Europe’s PV research machine is structured.

“We won the first battle, which was to create a solar industry,” Bes said, in reference to Europe’s early pioneering work in PV technology. “We lost the second battle and China won everything – not because they were smarter than us, just because they were richer than us and will continue to be.

“In the next battle, if we want to survive, why don’t we merge all the research centres in Europe? There are billions spent [on PV R&D] every year, but if there is no industry, what is the point? There is no point. Specialise each lab in one specific area – one lab in Switzerland could do the ingot, another one the wafer, another the cells.”

Bes also urged, as a matter of necessity,



The Sophia project focused on topics reflecting the whole PV value chain, from materials through to power generation.

Source: CEA-INES.



Europe’s PV market decline has made industrialization of advanced PV cell designs a challenging business.

Source: CEA-INES.



INES near Chambéry, France, the coordinating institute for the Sophia project.

closer working between Europe's R&D centres and European PV equipment manufacturers. "All the ideas you have in your heads, come and work with these people, because if your ideas can't be transferred into tools, it's useless – it's academic, hopeless. I respect schools and academies, but that's wishful thinking to create jobs in the future," Bes said.

He added that without urgent action, Europe's solar R&D community would soon face a similar problem to the one experienced over the past few years by its PV manufacturers, who have seen 85% of their jobs disappear. "How many jobs have been lost in R&D over last three years? I think it increased 25, 30%, so there is a big question mark: our situation is just a mirror of what your situation will be in the coming years. So if we don't want that to happen – and I don't want that to happen, because we need you – we need systemic change, and that has to be done by the European Commission."

Influencing policymakers

In the context of these macro-scale issues, which are of course inextricably linked to European energy and industrial policy, not to mention global trade forces, it was difficult not to wonder whether despite its laudable aims, the Sophia project amounted to little more than tinkering around the edges. And yet, the collaborative spirit apparently engendered by the project could prove to be the very platform needed to help the European solar industry survive.

Responding to the challenge to the European Commission laid down by Vincent Bes, Paul Verhoef, head of the renewable energy unit in the commission's directorate general of research and development, and another panellist at the

Sophia symposium, said there was a job for the European PV industry to communicate what it needs in order for the commission to respond in the right way.

"One can go to politicians either in Brussels or nationally to say we have a problem and we need help, but the first reaction you're going to get is fine, we've seen it, so what do you want help for, what are you going to try new, what is your plan, what can we support? I don't see the plan," he said.

"So let's see if we can get some sharp analysis and proposals on the table with which we can collectively go to politicians and say we've learned from the past, this is the way we're trying to reshape it, this is what we want to do, and move forward on that basis. Because otherwise I don't think you're going to get a very good reaction," Verhoef said.

Although Verhoef implied that policymakers in Europe were prepared to listen, he made it clear there would be no free meal tickets and that it would be up to the PV industry to communicate with one voice exactly what it wanted. In that context, the relevance of Sophia's legacy of closer relationships across Europe's PV community looks very different.

Future collaboration

The good news is that a successor project to Sophia is already up and running: Cheetah, the somewhat stretched acronym for 'Cost-reduction through material optimisation and Higher EnERgy output of solAr pHotovoltaic modules'. Cheetah will have many of the same partners as Sophia and even some new ones, and focus on many of the same topics. Less encouraging is that Cheetah will not, as things stand, carry on exactly the same activities as Sophia.

One source of disappointment is that Cheetah is not expected to continue the policy of free access to partners' research facilities instigated under Sophia. The continuation of this was one of a number of recommendations in a 'Strategic Vision on Photovoltaic Research Infrastructure' document published by the Sophia partners to mark the project's conclusion.

"The fee access [will end] but the staff exchange may go on, which is important," said Malbranche. "One of the successful things within the Sophia project was the workshops and especially the webinars. These will go on. The coordination of testing procedures.... All these, which were activities within the Sophia project, are still activities within the Cheetah project. The free access to some facilities – that was something specific from Sophia, and it's something that's currently not designed in the type of project such as Cheetah."

Also unclear is the fate of other proposals in the Sophia strategic vision document, such as the concept of establishing a number of large-scale pilot production lines to test-manufacture new PV technologies at meaningful volumes ahead of full industrial transfer. "When a manufacturer wants to check on real capacity, the yield and efficiency that you get using this equipment and this process, we could imagine some kind of coordination of several pilot lines at a European level. This is something which is not existing," said Malbranche.

Another recommendation made in the report is the necessary 'e-infrastructure' to link databases drawn from collaborative research work and make them readily accessible to researchers. "PV is going to be used in millions or tens of millions of installations, and it's good to be able to have as quickly as possible some feedback on the performance of a new technology," said Malbranche. "The idea is to have the tools to be able to do the same thing we have done within Sophia but within a more systematic way and organise the databases a user-friendly way."

Such proposals clearly have resource implications, and as such will most likely require backing from the commission. But as Verhoef made clear, such support will only be forthcoming if the argument for it is made coherently and by an industry speaking with one voice. Sophia would seem to have begun that process. The question now is whether it will be continued with sufficient vigour to prevent Europe's PV research community suffering the same fate as its manufacturers.

A full description of the activities and research projects carried out as part of the SOPHIA project can be found at http://www.sophia-ri.eu/fileadmin/SOPHIA_docs/documents/Communication/EUREC_SOPHIA-Booklet_2014_v5.pdf