

Supporting Innovation to Reduce Time to Market: The French Policy

—Transcript of a webinar offered by the Clean Energy Solutions Center on 20 October 2016—
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Webinar Panelists

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Sean

Hello, everyone. I'm Sean Esterly with the National Renewable Energy Laboratory and welcome to today's webinar, which is hosted by the Clean Energy Solutions Center in partnership with Mission Innovation. And today's webinar is focused on the French Policy for supporting innovation to reduce time to market. One important note of mention before we begin our presentations is that the Clean Energy Solutions Center does not endorse or recommend specific products or services. Information provided in this webinar is featured in the Solutions Center Resource Library as one of many best practices resources reviewed and selected by technical experts.

And I just want to go over some of the webinar features for you. You do have two options for audio. You may either listen through your computer or call in over the telephone. If you choose to listen through your computer, please select the mic and speakers option in the audio pane. And if you choose to dial in by phone, please select the telephone option and a box will display the telephone number and audio pin that you can use to dial in. If anyone is having technical difficulties with the webinar, you may contact the GoToWebinar's helpdesk at the number at the bottom of the slide. That number is (888) 259-3826.

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to cleanenergysolutions.org/training and so you can download those before or after the webinar and follow along. Also, an audio recording of the presentation will be posted to the Solutions Center training page within a few days of today's broadcast. And also, a reminder, we are now adding recordings to the [Solutions Center YouTube channel](#) where you'll find other informative webinars as well as other video interviews with thought leaders on clean energy policy topics.

So today's webinar agenda is centered around the presentations from our guest panelists Guillaume Meheut and François Moisan. These panelists have been kind enough to join us to discuss the Mission Innovation and how energy research and innovation are supported in France. Before our speakers begin their presentations, I just want to provide a short, informative overview of the Clean Energy Solutions Center Initiative. And then following their presentations, we will have our question/answer session where panelists will answer the questions submitted by attendees. And then we'll wrap up with some quick closing remarks and a brief survey for attendees.

And so this slide provides a bit of background in terms of how the Solutions Center came to be formed. The Solutions Center is one of 13 initiatives of the Clean Energy Ministerial, which was launched in April of 2011 and is primarily led by Australia, the United States, Sweden, and other CEM partners. Some outcomes of this unique initiative includes support of developing countries and emerging economies through enhancement of resources on policies relating to energy access, no cost expert policy assistance, and peer-to-peer learning and training tools just as the webinar you're now attending.

And there's four primary goals for the Solutions Center. First goal is to serve as a cleaning house of Clean Energy Policy resources. Second is to share policy best practices, data, and analysis tools specific to clean energy policies and programs. A third goal is to deliver dynamic services that enable expert assistance, learning, and peer-to-peer sharing of experiences. And then the final and fourth goal is to foster dialogue on emerging policy issues in innovation from around the globe. And the primary audience for the Solutions Center is typically made up of energy policymakers and analysts from governments and technical organizations in all countries throughout the globe; but we do also strive to engage with the private sector, NGOs, and civil society as well.

One of the marquee features of the Solutions Center is its no cost expert policy assistance known as Ask an Expert. The Ask an Expert program has established a broad team of now over 50 experts from around the globe were available to provide remote policy advice and analysis to all countries at no cost. So for example, in the area of renewable energy policy, we're very pleased to have Paul Komor from the Renewable & Sustainable Energy Institute serving as one of our experts. So if you have a need for policy assistance and renewable energy or any other clean energy sector, we do encourage you to use this valuable service. And again, the best part is it's provided to you free of charge. So if you have a question for our experts,

please submit it through our simple online form at cleanenergysolutions.org/expert. We also invite you to spread the word about this service to your colleagues and those in your networks and organizations.

So now, I'd like to provide brief introductions for today's distinguished panelists. First up is Guillaume Meheut who is the director of cabinet at the General Directorate for Energy and Climate Change at France's Ministry for Energy and the Environment. In this role, he helps to coordinate and implement the Ministry's research and innovation strategy, in particular in the field of clean energy. And following Guillaume, we will hear from François Moisan who is the executive director of strategy, research, and international affairs and scientific director at the Environment and Energy Management Agency. He is in charge of managing the Investments for the Future public fund which is dedicated to supporting innovation in low carbon technologies promoted by companies. And so with those introductions, I'd now like to welcome Guillaume to the webinar.

Guillaume

Thank you, Sean. Good morning, good evening, good afternoon, everyone. Thank you for joining the webinar on France. So I'm going to give you a broad overview of the French Research and Innovation Strategy in the field of clean energy, and then François will go into more detail about the Investment for the Future plan. So first, before I go into the details about the French Research and Innovation Strategy, let's have a quick overview of the French energy context. Just to point out two main aspects, which are the relatively low carbon aspect of the energy and especially electricity mix in France thanks to the high share of nuclear and also the fact that the main sectors as far as energy consumption is concerned are transport and buildings which explains the whole energy efficiency policy we have in France.

So this policy was mainly stated by the French Law on Energy Transition for Green Growth published in 2015 a few months before the COP21 in Paris and it's mainly driven by two objectives, reducing the dependency on oil, preparing for the post-oil era, and launching of dynamics for green growth based on building retrofits, our renewables development, sustainable modalities, circular economy. So it set quantified goals like you have on the slides, which were the basis for the French contribution to the Paris agreement. For instance, 40 percent less greenhouse gasses in 2030 compared to 1990, 32 percent of renewable energy conception at that same date.

And I'd like also to highlight the carbon price we are setting in France which is increasing every year with a target of EUR 56 a ton of carbon in 2020 and EUR 100 in 2030. To achieve these ambitious goals, there is a crucial need for our research and innovation; and the law sets a framework and creates or already designs some policy tools, one of which is the National Energy Research Strategy, which itself takes into account the more broad policy tools for energy and climate in French. For instance, the National Low Carbon Strategy that sets some carbon budget for the 10 to 15 next years and sets also some policy orientation and the Energy Research Strategy also takes into account the Energy Annual Plan which is about to be published and also it

sets the demand management measures and defines the energy mix for the next 10 years. For instance, there is a renewable development plan and targets to reach more than gigawatts of wind and solar by 2023.

So this Research Strategy focused on energy, also has to precise the National Transversal Research Strategy which was published last year. This global research strategy must be taken into account in the work programs of research organization and also of course the annual programming of funding agency. It is very much like the European set plan built around 10 great societal challenges that help us setting priorities and enable stakeholders to regroup around these priorities. Some priorities which are interesting here are the security and efficient energy, sustainable resources, and mobility.

In the field of energy, this National Energy Research Strategy since challenges around the management of energy systems, the multi-scale governance of the system, and also energy efficiency and the decarbonization of energy and chemistry sectors. The Energy Research Strategy, which is currently a work in progress and we hope to publish at the end of this year. We'll elaborate on these topics and propose some implementation orientations. It will probably focus mainly on systemic approach at two levels. On the one hand, the system, the energy system itself taking into account at the same time production, storage, management, transport, and delivery of energy but also the systemic approach regarding energy in a broader set together with environment, socioeconomic issues, and of course of the digital revolution. The idea is also to consolidate the basic energy research community and foster public-private collaboration. The Investment for the Future program is one of the tools and also we have the concern of trying to articulate the research and innovation policies at different geographic levels because we have quite a lot of tools at the national level, but we also have the European level, I mentioned the set plan and Horizon 2020. We also have our local authorities and regionals very active, increasingly active in research and innovation in France. And of course, we have the Mission Innovation at the international level.

So the public support given this framework and strategies is mainly organized with two types of funding. We have first direct budget allocations to organizations, to research organizations that carry out research program with their own in-house researchers. I have mentioned on the slide CNRS, CEA, and IFPEN. CEA is famous for of course nuclear research but also new energies, solar storage. IFPEN is a very active on oil and gas, but also biofuels and also offshore technologies. On the other hand, we have some agencies, public agencies that fund research and innovation programs mainly based on call for projects. On this slide, we have a small drawing showing that on the TRR scale we try to cover the whole chain. If we start at the basic research, we have the National Energy Research Strategy which is a generalist agency that also has a program on clean energy. Then we have the ADEME and François will explain to us what they do in a demonstration on industry research to bring new technologies and solutions to the market. And also we have the Public Investment Bank, BPI which is generalist but also

active on energy. And that's all who is quite active helping scale up technologies to industry face.

So if we put these elements in broad picture. This is what the general system in France looks like with the policy levels with ministries so the Ministry of Research and other ministries along which the Ministry of Energy which I belong to and then the agencies and then the research organizations. Also, I'd like to mention that our research organization grouped into alliances, thematic alliance. We've got one alliance on energy which is called ANCRE, and that helps discuss the policy between the government and the research organizations.

So let's have a look at the final chart of figures now. The public energy supports for research rose from around EUR 800 million ten years ago to more than EUR 1 billion per year in the recent years. So we had a big rise, especially on the field of what we call new technologies for energy that are renewables, energy efficiencies in oil fields, and grades and storage. Nuclear has also remained a big research thematic in France.

And if we have a look at the distribution of funding between these new technologies for energy, we can see that energy efficiency is a very high priority in France as well as renewable, especially bioenergy and solar and also all technologies related to flexibility which are smart grids, storage, and also hydrogen and fuel cells.

So this is the main basis for the French commitment to Mission Innovation which is a coalition launched in Paris at the first day of the COP 21 last year, and France will focus for Mission Innovation on these new technologies for energy which I mentioned already. And the baseline based on the average state directed funding on the 2012-2014 period is around EUR 440 million per year. So this is state funding so it does not include local authorities funding, and also it does not include the French contribution to international program such as the European program Horizon 2020. French contributes at the same level as its contribution at the global European Union budget which is around 16 percent. So the main, the doubling effort in five years will mainly go through the Investment for the Future program. In French, Programme d'Investissements d'Avenir, PIA as we call it, and it covers the whole change of innovation from basic research to demonstration.

So the idea of this program is supporting to share the risk with company and research organisms in developing innovative solutions and in accessing new markets. It's a very important financial effort for low carbon innovation. There was a first round launched in 2010. The second round launched in 2014, and there is a third round in preparation with the budget law coming by the end of this year. This third round will begin next year. So one thing important to highlight in the PIA is that it uses various financial instruments to adjust to the needs of researchers and innovators along the TRL scale. So at beginning, subsidies but also refundable grants and at the end equity and loans to help scale up solutions to the market. So the general idea is to get, whenever possible, a return on public investment. That concern helps also

work with researchers and innovators to build business models.

So now several operators active in this PIA, I already mentioned them—a research agency, ADEME and BPI. So François will present in detail the ADEME's action so I will have come back to it and BPI I won't either present in detail because its action is quite similar to ADEME but on a broader parameter of technologies. So if you need more information, I've put the website link at the end of the presentation.

Let me say a final word about the research agency action which is called the Institutes of the Energy Transition. So it's a quite ambitious model. We tried to create new public/private structures delegated to research and development and innovation in the field of clean energy. So the idea is to bring together companies and public laboratories that would work together in a common structure that could be a company with dedicated assets and staff. And the activities will range from basic research to industrial development and eventually the launch of new products on the market, but there are also activities about training to disseminate these new research and new knowledge in the sector. There was a budget of EUR 1 million in 2010 on this action, and we have several institutes that are active on various topics of the energy transition. I've listed some of them but not all. So we have institute working on grids, connected vehicles, also an institute working on solar, also bioenergy. We find again the highest priorities of French energy research. So that's it for my presentation. I give you few links if you want to go further. I thank you for your attention and I give now the microphone to François.

François

Okay, good afternoon or good morning to everyone or good evening for those who are in eastern countries. So I will focus my presentation on the program Investment for the Future mentioned by Guillaume and the program managed by ADEME. So Guillaume indicated there was EUR 5 billion spent in this programs, apart from the National Agency on Research just mentioned. ADEME manage one part of this program, and we will focus from this. Also a preliminary remark, ADEME as Guillaume mentioned is in charge of research program, more upstream, more close to research, let's say which I will not present today as the research program managed by Guillaume is EUR 30 million per year so it's much less amount than the program Investment for the Future.

So to go on the presentation of this program, first the thematic fields that we address in this program through two part. One part is dedicated to what we call demonstrators for energy and ecological transition. So this program focus on energy efficiency in buildings and industry but also renewable energy with a different renewable production but also smart grids, energy storage, hydrogen and fuel cells and also some research not regarding energy for small part—biodiversity, waste, soil depollution but this is a small part of the program. And another program dedicated to transport and what we call future vehicle and transport, and this program is addressing the road vehicles, the motorization, hybrid, thermal, electric, lighter vehicle, trucks, mobility but also railway and the future boats. It doesn't address [inaudible] in this

program. So the objectives of this program is to promote innovation since we are downstream rather than upstream in the research process. So we address the innovation and industry on research done by companies rather than public, even if public could be associated to the project. And the principle is to share the risk between the government and the companies.

In order to precise the kind of projects we support, there is work that could be rather long-term project for which market is a longer term. It can be rather short term in terms of TRL, technology readiness level. We could be in majority between seven and nine level of TRL. And the costs of projects are for large part quite big projects since the average cost is EUR 10 million per project, and 80 percent of projects represent 35 percent of the credits that has been dedicated to the program. The projects that we support are technological innovation. It will be demonstrators but also it can be experimental development. It could be pre-industrial experimental or even the first industrial. And every time it's industrial in terms of technology but also of market and organization.

So a lot of the amount of credits we have for multi-year programs since this program began in 2011 and until now 2017, we have EUR 3 billion to spend for innovation driven by companies. We have two kind of support. It will be we come back on this differentiation. We call bringing state aids, full grants, or reimbursable subsidies; but we could also act through capital intervention and in that case, we support the company projects with participation to the capital always minority capital.

To precise this kind of to these two modalities of funding which are not correlative. That's meaning you cannot use both in the same project but we could bring some state aids. And we are in most cases with an interest of the state for that funding. That's mean that a part of the aids are reimbursable in case of flexes. So the company will receive the subsidy should reimburse a part of this subsidy. We have a part of grants, but as it is collaborative research for most part, the grants are reserved in priority to the public labs which of course are not the market benefits. The projects are funded through competitive call for proposal and we are under what we call EU framework for state aids regulation. That's mean that we could support some company projects in the research and innovation field, but of course we could not support a company in market activity, commercial activity. So this is controlled by EU commission. The other way to add and to support investments is, as I said, through capital investments and then it's always through equity or quasi-equity. The public intervention is minority, and we are cofounding with other private actors. And in the logic of what we call advice investor. That's mean that we have to request the same efficiency of investments and the economic efficiency of investments are and the private actor will have done. In that case, there is no state regulation and the require is the economic cost effectiveness of investments for the state.

What we have done, what have we done on these programs since 2011. So as I said, the truest target is to companies. Eighty-five percent of budget is going to companies. The 15 percent are going to public labs mainly. Half of

beneficiaries are small business companies. We acted through two kinds of call for proposal. First, the majority was call for proposal for projects of large size. This was done through contracts with companies, contracts with reimbursable aids, and in average a contract with companies around EUR 2.6 million in reimbursable aid by partner. In a project, we have also an average of less than EUR 400,000 in terms of grants by partner that could be public labs but also small business companies. Each project is conducted by a consortium of four or five partners in average. This could be some large companies, several small business companies, and public lab.

But we have recently other kind of call for proposal which are dedicated to SBCs; and in that case, we support with only grants, no reimbursable with a maximum aid of EUR 200,000. This program has been for a tool for innovation since 2011 we launched 67 calls for proposal in the thematic I presented at the beginning for last project. And for almost two years, we launched 13 calls for proposal dedicated to SBCs. So you see there is a different approach. In the first start of the program, it was mainly a large program and now we also focus on the SBCs. Since 2011, we selected and supported more than 500 projects. And as in each project there is several partners, total is 1,500 contracts with different companies. And this program has a very strong leverage effect since when we put EUR 1 the partners but EUR 2.9 so we have leverage effect quite important to enhance innovation in companies.

At this stage, we spend EUR 1.2 billion as September this year and with state aid regime and we invest EUR 430 million in venture capital that has been done through ADEME directly through special vehicle companies. That's mean, for example, with a very large company we create a subsidy company in which we invest with a large company. ADEME remain minority in the minority capital and of course, the strategy is done by the company. But for the state, the idea is that if this is a success a term of the company and we will get our investment with value added. We have also another investments in capital specifically for small business companies. It's a venture capital fund. We called it eco-technology and at this stage, we invested EUR 35 million invested in SBCs, always in minority. That could help businesses to go for what we call the develop [sic?] and to help them to grow.

I will just give some example of the kinds of projects of some projects among the 500 we supported since 2011 and some example in different way to support the different companies. This example is projects managed by Alstom, now General Electric. As you know, the activity of Alstom Energy have been taken by General Electric in France. So, this project is on large wind machine. It's a development of six-megawatt wind turbine. And so, we created with Alstom, now GE, SPV a specific subsidy between GE and ADEME. The idea was in France that we need a contribution of offshore wind energy in 2020 and beyond, of course, of renewable energy in the energy mix; and we will need offshore wind production.

So we invest in the construction of the industry itself and creation of 7,000 direct and indirect jobs through our investments in capital. The idea was the

development of a new machine wind turbine, the Haliade 150 with pales of 150 meters diameter. It is disruptive technologies and different disruptive technologies adapted to offshore direct drive, generator with permanent magnets, et cetera. So, the place of these industries in Saint Nazaire in west of France. It was launched on January 2013. And so we are going now further in these companies since it's the first machine are now going on the market in different places in the world.

Another example of project we supported is the project we call PV800. It's the idea was to manufacture solar quality silicon wafers from metallurgic silicon. So the idea was proposed by a company called ECM was a specialist of crystallization furnace manufacturer. This company, they developed an innovative furnace to transform metallurgic silicon in solar quality silicon. In that case, it's state aid. So it's grant and reimbursable aids. The amount of the projects was above EUR 22 million and we supported the project at the level of EUR 7 million. So that was in May 2011 so at the beginning of the program, and now ECM already sold ten furnaces at international level, and ADEME and the state will get some return on this investment since there was reimbursable aids associated with the grants.

Another project is project EXOSUN. EXOSUN is a company manufacturing solar trackers for utility scale power plants. EXOSUN is a small company founded in 2007 and is leader in the French market designs, develops, and supplies a round of solar Exotrackers, which can increase the PV power plant yield. So following the sun, it can increase the yield by 40 percent. The company is located in Gironde in southwest of France, and this small company offers a full range of engineering service besides the technology itself covering the entire lifecycle of a plant from the initial studies to commissioning operation and maintenance. In that company, it was an investment in capital so invest EUR 12 million with other investors—Capital Fund, EDF Energies Nouvelles, and regional fund of development. The localization of the company is in France of course, but also now in US and South Africa. And to date, EXOSUN has installed a capacity of 400 megawatt. So for us it's a success.

Another program project we supported in the field of smart grids, which is quite different of course. In that case, we supported in France more than 20 demonstrators of smart grids since the idea was to experiment the integration of renewable electricity, decentralized production in the grid with a constraint and problems raising by the important amount of renewable. There is also the problem of storage of electricity, the problem on the demand side to have load shifting through different DSM programs for example. So the idea of these demonstrators was to experiment different solutions from the point of view of technical issues but also of business models since these smart grids are bringing very new opportunities of business.

So this program was experimented in Lyon, which is one of the biggest cities in France, and Grenoble close to Lyon. The idea was to deploy innovative solutions as I mentioned. The value chain for customers, distribution grid managers, suppliers, energy generators, the industrial equipment

manufacturers but also local authorities were involved in the project. We had to experiment integration of all components into the smart electric system and taking into account environmental, societal, technological, and economic issues. The total budget of the project was EUR 37 million and the subsidy, which was roundabout, but mainly reimbursable aids was slightly below EUR 10 million. The specificity of this demonstrators was that we involved in the project itself 1,000 residential customers and 40 tertiary commercial or office sites, you know to test, to experiment DSM load shifting. As a localization I said was Lyon and Grenoble, and it was now completed, and we had the balance and the result of the road projects right now. As you may see, there is several big companies involved in the project in terms of energy producer, distributors. There were also equipment manufacturers and labs, public labs.

Last example, I will present this last example which is an example of quiet and of demonstrator process in the field of tidal energy since France is interested in this type of renewable energy since we have many coastal areas in France and overseas island. And we think that we may need to have this energy from sea in our portfolio of energies in order to reach high share of renewable energy since there is not a problem of space occupation that we are encountering on the French territory itself. So we had several call for proposal on energy from sea, and we had first demonstrators. We had also technological components specific projects, and at the end, we had what we call tidal energy pilot farms. We had call for proposal on these farms. In that case, the idea is to have projects which are producing energy connected to the grid. So it's not just a demonstrators but it's last stage before commercial deployment.

So in this call for proposal, we selected two projects of tidal energy farms. One, the NEPTHYD project, it's a power of 5.6 megawatts with four turbines. The cost is about EUR 100 million and the subsidy is about half of this cost of the project. It was beared by ENGIE, GDF SUEZ now called ENGIE and Alstom, now General Electric, the name change. So the experimentation is on close to Normandy and close to what we call et Blanchard. It's a place where there is the highest current close to the French territory. The other project is NORMANDIE HYDRO, a 14-megawatt with seven turbines. The cost of the project is above EUR 100 million and the subsidy slightly less than half of the cost with two main partners, EDF Energies Nouvelles as energy supplier and DCNS who is the company producing the turbines itself you see on the picture right now.

So these project showed variety of different kind of projects we are supporting and presenting. I come back on the issue that we have two kind of intervention. One is the state aid with grants and reimbursable aids. In that case, there is return for the state hopefully, but there is a risk. The second intervention is through capital investment. But in that case, also of course, the idea is that if it is a success, we have the vocation, the principal to stay for five, seven, maybe ten years; but after that, if it's a success, we'll get off the capital and instead we'll get some value added. But of course, it's need to take some risk and other energy transition need to take this risk and that's why

there is this public programs that ADEME is managing for the government. I will stop there and we'll take the question. Sean, I give you the floor back.

Sean

Great. Thank you very much, François and also Guillaume, for the excellent presentations. As François said, we will now go into the question/answer session. So just a reminder to each of our panelists—or I'm sorry, to all of our attendees, if you have any questions for our panelists, please go ahead and submit those to the question pane and we can address those now. So we did receive a couple. We'll start with the first one that came in and that is asking in what way do you anticipate Mission Innovation specifically changing France's energy research strategy?

Guillaume

I'll take this one. This is Guillaume. So actually, Mission Innovation is an opportunity to accelerate the research programs in France. So we have a quite rich set of tools already existing and running, but the idea is to scale up those tools and to accelerate. So one of those is the PIA program that François just presented and we are trying to go further, faster and to launch a new bench of cold power projects and to double that investment in the focused technologies so that we have more impact on the market at different time horizons, both medium term, the 2030 or maybe before, and also the long term, 2050 and beyond, also by supporting low TRL research.

François

Maybe I could complete just to what Guillaume said, saying that at this stage there is of course some international collaboration and cooperation, I think for example through IEA programs and so on. But I think Mission Innovation is the opportunity to have other kind of cooperation. Of course, when you speak of industrial cooperation, it's not just simple because there is industrial property and industrial property issues. But nevertheless, I think if we have more than 20 countries with research on these issues delegates, it will raise the exchange, at least information on what each country is doing in terms of research and innovation. And at the end of course, we look after for some cooperation at the level of research of course, but maybe also at the level of companies.

Sean

Great. Thank you both. I'll move on to the next question, and it asks if you're aware of any projects in carbon capture in utilizations that are ongoing?

François

Okay, sure. In the first slide I presented, there was the list of the call for proposal. We launched call for proposal on carbon capture and stored energy utilization. In fact, there is now two—and we funded several projects in this field. We had the very successful projects conducted on capture of CO₂ on cold power plant, for example; and there were other programs. There is several large French companies and research center involved in this topic. In terms of storage of CO₂, it was more complicated. We have difficulties in order to find sites of experimentation and the cost of these projects. So we should say that we have problems on the storage experimentation; but as I said, some success on capture. And now the utilization of CO₂ appears as new ways. At the beginning, it could be looked at as marginal, I must say; but now we were several projects of CO₂ valorization. And for example, through the production of methane or derived chemical products with hydrogen, so mixing CO₂ from industrial processes power plant with hydrogen pollution.

Hydrogen potentially coming from electricity, not use electricity, from renewable for example. We see that there could be some opportunity to mix the CO2 and hydrogen in order to produce methane or other chemical product. So that can be a way also to have this valorization. Guillaume, you want to complete?

Guillaume Yeah, just wanted to give the name. We have a big project called Jupiter 1000 in the South of France focused on power to X, what France suggests is playing with the transmission grid and distribution grid operators for gas and electricity involved.

François And maybe to conclude, I should say that since the US is in the path of the utilization is much more—there is much excitation in the population and even at the political level because the storage is more complicated.

Sean Great. Thank you both again. Next question asks if you can share what the degree of reduction of time to market that has resulted from your projects?

François I should say in France we are by the past and we are still quite strong public research. So I say with share going from one to four, five let's say. But maybe in comparison with other countries, there was some analysis saying there was less and lack of innovation beared by the companies. And so the program is dedicated specifically as you have seen in the slide I presented that the idea is to show and go with the companies on the risk for innovation. As I said, we have 500 projects supported. These projects began in 2011 for the most all of them, the first one we supported. And in fact, the time of conducting experimentation, demonstration of these projects is about four years let's say on average. So in fact we are right now just beginning to have the first projects close now, and we have the research right now, and we have not shown much of a time lag to see how much this is going to be produced in commercial product. But we began for the first one to have some return on investments. Because the company was succeeded at giving back the reimbursable aids, began to provide these reimbursable aids and we may think that that's about two to three years accelerating the way to the market. I think Guillaume wanted to complete?

Guillaume Just wanted to give an example of field in which we have great success, which is smart grids. Strong of these demonstrators, 20 or more demonstrators, we have launched national code for big projects. Now we have two pilots at the large scale, at regional scale in Brittany and in the South of France. The idea is to deploy in the same region, all the technology called bricks. I mean it's in a complete and coherent system. So we'll see a large-scale deployment of smart grids in the next two or three years in France.

Sean Thank you, Guillaume and François. Moving on now, we have a question about the ADEME and the program. They ask, are foreign firms allowed to participate in ADEME programs or is there another program where foreign companies can participate?

François Well, in fact the principle and it's not specifically the PIA, managed by them, the principle of all the programs by government is that it's the eligible

projects are those who are conducted in the French territory. That doesn't mean it's only French companies, but the research and development and the innovation should be done on the French territory, and I think the same in many countries. And so we supported some companies who are not French ones, but they are activities in France. Guillaume, you complete?

Guillaume

Yes, on top of that, France participates in what's called ERA-NETs at the European level, which means several countries are involved in a common program. Each country funds an equal part of the projects that are at least binational or more. So we also give planning from projects that are international.

Sean

All right, thank you. Next question asks or well states, reimbursable grants are a large part of your portfolio instruments. What are the typical conditions under which you call in the grant and also are they considered a state aid by the European Commission?

François

Okay, important question. In our war program as I said, if I put apart what is a capital investments which is not state aid and not regulated by in a commission regulation, all that is state aid, whether it's grants or reimbursable aids, are within the scope what we call the European Regulation on state aids to companies. The amount, the percentage of reimbursable aids in the whole set of aids is about 70-80 percent. So it's a main part 70-80 percent of the whole budget of the, I said one billion before, I think at this stage is a reimbursable aids. The others, the 20-30 percent are grants. And as I said, the large part of these grants are going to public labs and in some case for small business companies and in same case for the most upstream research done by companies.

But reimbursable aids are the main tool on these programs. And so in fact what we do, we contract with the companies. We bring some amount of aid. And in the contract there is, for example, the company as far as the project ended and it's a technical success, let's say, the company reimburse half of the reimbursable aid. And the second part, the second 50 percent of the reimbursable aid is linked to threshold in the market. And for example, the company is producing new motor for example or new wind machine or so on. So it's some amount of machine, of motors, or it's a percentage of the sales of activity in terms of commercial activity that's made since the company reach this threshold, they have to reimburse the last 50 percent of reimbursable aid. I'm not sure if it's clear.

Sean

Thank you, François. Next question is asking about CO2 price. They're asking what you regard as feasible instruments for having a higher CO2 price or creating a higher CO2 price?

François

The question is what instrument? I'm not –

Sean

Yeah, do you see any feasible instruments for creating a higher CO2 price in a CO2 market?

Guillaume Well, I take this one. It's more a policy question rather than a research and innovation question; but anyway, France is very active in promoting carbon price. So what we do is we have both the carbon emission market at the European level for intensive innovation industry, and we also have a carbon tax in consumption of fuels at national level. France has made proposals at the European level to reform the market, the emission trading system, so that there is a certain threshold, a minimum level for this carbon price that would rise every year in the same way as in France we raise the level of the carbon tax in the fuel prices every year by the finest role.

François Maybe to complete on that question, because you may have an explicit cost of CO₂ through a tax or through permits. But of course, in the economy there is other less explicit CO₂ value, let's say. For example, first through a value, but some companies have internal price of carbon in order to decide their long-term investments, for example. But there is also some other issue that could give some value at the CO₂. And for example, if you look at the many companies who took commitments after the—before or after the COP21 on their CO₂ emissions, these companies and these commitments are on the Nascar platform, you may know right now. What we see more and more is that the investors, the fund will invest in companies in action for obligations. They are looking at what is the carbon in their portfolio. So there is and I think there will be more [tone] activity. You should decrease your carbon footprint and so there could be some pressure coming from investors to other companies and the activities in order to decarbonize their activity. We are far from research, technical research right now, but this is important issue.

Sean All right, thank you for taking the policy question. We have two specific technology questions that came in. So I'll just ask them at the same time. Are you looking into or considering research in next generation nuclear power? And also, are you looking at algae production for energy production at the pilot scale level?

Guillaume We did not quite get the second question. Sean, can you explain a bit?

Sean Yes, so the first is about research in next generation nuclear power and the second is asking about the use of carbon dioxide use for algae production at the pilot-scale level.

Guillaume Carbon dioxide?

Sean Yeah, that's three very—

Guillaume Okay, that's very interesting. I'll answer the question about nuclear. Yes, of course, nuclear remains very important in the French electricity mix. The law on energy transition sets a target to keep 50 percent of nuclear in the power system in 2025. So we have a lot of research on this field and on next generation nuclear power. We have projects about fourth generation demonstrator, a project called ASTRID, run by the CEA. We also have in France the project, ITER, about energy fusion, which is much more long term.

François When you ask the second question, we are not sure to understand that. Do we have pilot plants with CO₂? I'm not sure we understood the question.

Sean Yeah, that's okay. We can come back to that one. Well, what they're wondering is if you're using flue gas carbon dioxide for algae production? It sounds like they're referring to a pretty specific technology.

François CO₂ flue gas for energy production?

Sean For algae production. So it looks like –

François Ah, algae. Sorry, we did not for algae. Yes. Yes, well in fact in the biochemistry—sorry, I did not understand algae. So we had some projects but not successful, let's say, at this stage. But it remains some opportunity, but it's difficult. Of course, there were several projects on this issue, but we should submit maybe that this kind of what we may call third generation of biofuels is still quite upstream—demonstrators, research and demonstrators. Of course, we have great interest in, but at this stage not large experimentation.

Sean Great. Thank you very much. And that is the last question that we received from the audience up to this point. If anymore come in, we can always address them. But since that's the last one we have, we'll move along now. We do have a brief survey for each of our attendees to complete. So I'm going to go ahead and display that. The first question should be up now on your screen. You respond right through the screen. The question states “Webinar content provided me with useful information and insight”. Thank you. And second question, “The webinar's presenters were effective”. And third question is “Overall, the webinar met my expectations”. And then we just have two more yes or no questions for you. The first one is “Do you anticipate using the information presented in this webinar directly in your work and/or organization”? And the final question, also yes or no. It is “Do you anticipate applying the information presented to develop or revise policies or programs in your country of focus”? Great. Thank you for answering our survey. We do appreciate it. Did have one more question come in that I'd like to ask the panelists as I think it might be of interest to a lot of our attendees. It's asking how do you ensure the knowledge transfer from basic research to industrial applications, and how much funding do you have for this? François and Guillaume, you're still on mute if you're trying to respond.

Guillaume Yes, we're just thinking. How do we assure the knowledge transfer from research to companies actually? What François presented is that we're funding collaborative research between those companies and labs. So the idea is that this transfer is done within these projects. We also fund institutes in which laboratories and companies are present. So this is another way of having this transfer. So this idea is present all over our programs and it's quite difficult to give percentage of funding that we allocate to this. This is a common principle that we try to have in all the public support schemes in France. Maybe François wants to precise.

François

No, maybe to say of course if we want to support industrial projects, the cost is higher and because you're dealing with large equipment and the demonstrators are larger than the pilot phase. So the amount dedicated to the initial research is often higher in that case for specific item. Maybe the opportunity also to share with you the fact that as you may see, we try in France to support the whole chain from the basic research to the stage before the market as it is done—as it could be done within the stated regime and levered at least. But what we consider also is that there is, even if we have technology ready to go to the market, there is still some difficulty for the new technologies to go beyond that stage as a first commercial technology. Because if you want to fund a projects, for example if you look at these offshore turbine large machine, for example, it's difficult for developer, for renewable energy company who respond to some projects of make several thousand megawatts, for example, to produce commercial electricity. It's very difficult to fund when it's a new technology only with a debt for the banks.

So we have the reflection in France, we are thinking for the next stage of the program Investments for the Future, maybe to go through capital investments in that ultimate stage or the first of a kind, what we call first of a kind commercial activation. Because if we want to accelerate the penetration of this technology, maybe it's justified to go until that stage. In that case, it's through capital investments. It could not be for state aid at this stage and participating through the investments with a perspective again of return for the state, financial return for the state.

Sean

Thank you François and Guillaume. And so that we will move on and wrap up the webinar. So again, Guillaume and François, thank you very much for the presentations and also for answering those questions from the attendees. Also, we really want to thank our attendees for taking their time out of their days to participate in today's webinar. We do appreciate it. And I invite each of the attendees to check the Solutions Center website if you would like to view or download the slides from today's webinar. Also, a reminder we will be posting a recording of today's presentations on the webinar page as well. Additionally, you will find information on upcoming webinars and other training events on the Solutions Center website. Also, a reminder, we're now posting webinar recordings to the [Clean Energy Solutions Center YouTube channel](#). There's also a lot of other videos on clean energy topics out. So definitely worth checking out. We also want to invite you to inform your colleagues and those in your networks about the Solutions Center resources and services including the no cost policy support known as Ask an Expert. And so with that, I hope everyone has a great rest of your day and we hope to see you again at future Clean Energy Solutions Center events. This concludes our webinar.