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HUMAN RESOURCES DEVELOPMENT IN NEW NUCLEAR ENERGY STATES

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P R O C E E D I N G S

MR. EBINGER: Good afternoon, ladies and gentlemen. We're delighted you joined us this afternoon. I'm Charlie Ebinger the Director of the Energy Security Initiative here at Brookings and we are pleased to have this launch event for our most recent paper called, *Human Resource Development and New Nuclear Energy States* with case studies from the Middle East. To give you a little background on this effort, back in 2011 we embarked on research to examine the status of nuclear power plans in 9 Middle East countries and this is a region likely to play host to the first newcomer nuclear energy states of the 21st century.

Back in March 2011 we published a comparative analysis called, *Models for Aspirant Civil Nuclear Energy Nations in the Middle East*. And during the course of our research during this first phase, we found that a common theme repeatedly emerged and that was the challenge of developing and maintaining the necessary human capacity to run both nuclear programs and public sector nuclear related institutions. We see this as a critical component of the development of safe, secure, and sustainable civil nuclear programs in the region and indeed, throughout the world. We therefore decided in this stage of our research to focus exclusively on this subject.

The yearlong study looked at the challenges and opportunities of human resource development and the region's civil nuclear energy sector. We narrowed the scope of our research to only three countries, the United Arab Emirates, Turkey, and Jordan because we believe these three countries are the most likely in the region to have grid connected nuclear power within the next decade. The objective of the study was to solicit and document the views of officials and representatives from the subject countries on the challenges to human resource development and to analyze the effectiveness of current strategies, the gaps in current policies, and the feasibility and effectiveness of

regional collaboration.

The study involved extensive primary research, travel to all the countries in question, meetings with relevant organizations such as the International Atomic Energy Agency in Vienna, a seminar that we hosted back in May in Abu Dhabi, and a review of literally hundreds of policy and other relevant documents. We released the findings today. I think copies of the study were available at the registration desk. Electronic copies are also available online. If you did not get a paper when you registered, I'm sure they'll be out there at the end of our presentation. To take you through the design findings and recommendations of the report, I will hand the podium now over to my two colleagues, Kevin Massy and John Banks who are the two principle authors of the report. Thank you.

MR. MASSY: Thank you, Charlie and welcome to Brookings. I'm Kevin Massy the Associate Director of the Energy Security Initiative and as Charlie said, one of principle authors of the report with my colleague, John Banks. For today's presentation, I'd just like to walk you through the design of the study and then get to some of the findings and recommendations. The first thing to acknowledge I think, is that our work built on a large body of existing research and a large foundation of literature on human resource development and nuclear energy. Principally, that have been done by the IAEA and in order not to duplicate that work we try to integrate into our work as much as possible their very good definitions and leading thinking on these issues.

We did have some difference with the existing literature. The first two things we really set out to do were to arrive at a definition of human resource development and nuclear power that met our objectives. Human resource development encompasses a wide range of issues from recruitment through retention to retirement. But for new nuclear energy states we saw that the principle issues of relevance to be four

areas and they were in order workforce planning which we saw as encompassing an assessment of present and future competence and requirements relevant to available skills. And for new nuclear energy states, workforce planning really pertains to three principle institutions: the regulator, the nuclear energy program implementation organization or the NEPIO, and the operating company when the plants go live.

The second element in our definition of human resource development was training and education and of course, this should be closely related to workforce planning. The third was recruitment which is pretty self evident. But in our definition we broaden the scope of what is understood by recruitment. We saw it as more than interviews and the formal hiring process. We saw it as encompassing the broader goals and culture of the nuclear program. And the fourth element of human resource development we saw as stakeholder engagement. Now the IAEA does not include stakeholder engagement in its definition of human resource development. We did for reasons that we'll get into later in the presentation.

Having decided on a definition we then set about to work out an analytical framework for assessing each of the three countries, the UAE, Turkey, and Jordan. And we did this -- we agreed to focus on a framework that really assessed them relative to two criteria. The first was competence. This is the ability of the host country or the new nuclear energy state to be what the IAEA calls an intelligent customer and a qualified overseer of civil nuclear power. In other words, it's getting the right people in the right place at the right time. And competence was a large part of the focus, but competence often is I think, restricted to the operational elements of the nuclear program.

We broadened the definition of competence to include the institutions that have responsibility for licensing, regulation, and oversight of the programs; regulatory competence being especially important for new nuclear energy programs and the

countries that don't have any history or operational history of nuclear power. The second aspect of the analytical framework is sustainability and this refers to the extent to which a country possesses the long-term capacity required to operate, maintain, and regulate the civil nuclear power assets. The main issue with regards to sustainability is often expressed in terms of how much indigenous capacity the country has relative to how much it relies on external expertise.

There is nothing inherently wrong with reliance on external expertise. Indeed, the IAEA recommends that countries do bring in external expertise in the early stages of a civil nuclear power program, so external expertise itself is not reason for concern. However, there are reasons to be concerned about overreliance on external expertise. The principle one here is the shape and the dynamics of the civil nuclear workforce worldwide. We're seeing a large number of mid and senior level nuclear professionals set to retire globally over the next decade. There's a graying generally of the nuclear profession in the OECD. And as newcomer countries arrive and try and implement civil nuclear power, they're going to be competing for this shrinking pool of human capital and the challenge to attract and retain the necessary talent to run their programs is going to increase over time.

The second element of sustainability is political. In the course of our research we found that a large element of human resource development is connected to the political viability of the programs themselves. The extent to which a program enjoys institutional and public sector support, that is the social license to operate, really affects the sustainability of the program. And we see this generally in our work in energy policy worldwide. The whole idea of social license to operate, public acceptance, stakeholder involvement is growing in importance whether it's in oil sands or in fracking or in arctic offshore development, the role of the public and of stakeholders is becoming an

increasingly important issue.

So that was the frame of the study at the outset. So what did we find? Well as I'm sure you know, these countries are very different in size, in population, in their history of nuclear power, the level of wealth, and many other elements. The first set of observations I'll give will just be an update or status update on where the countries are with the development of civil nuclear power. The United Arab Emirates is by far the most advanced in its plans. The UAE set out in 2008 a white paper that outlined its intentions to pursue the option of civil nuclear power and looked at a variety of issues that it would need to address if it were to go ahead with a decision.

It then did go ahead with a decision to implement civil nuclear power and purchased four reactors from a South Korean consortium in 2009. The UAE has a stated objective of getting civil nuclear power connected to the grid by 2017 and we can't see at this stage any reason why that's not going to be achievable. The UAE has in general, I think, a well designed and well funded strategy for the implementation of civil nuclear power. It has set up an independent regulator, it has a nuclear energy program implementation organization, and when it comes to human resource development it really seems to recognize the importance of trying to build a domestic indigenous capacity to run and regulate its program.

It has one graduate level program at the Khalifia University for Science and Technology in nuclear engineering. It has set up what it calls, Institute for Applied Technology to train vocational professionals and has a number of programs, initiatives, partnerships, exchanges with other academic institutions outside of the country. Jordan is at a very different stage. In 2007 it set out a policy of nuclear power implementation and said that it would have 6 percent of its energy met by nuclear power by 2020. It has still a policy of getting its first reactor online by 2020. It shortlisted three firms for the

construction of its first reactor in 2010.

They were a consortium -- a French-Japanese consortium Canadian company and a Russian company. Earlier this year it narrowed the selection to two and the two that made the cut were the French-Japanese consortium and the Russian company. And it is said that it will make a final decision in time to start construction of its first civil nuclear power plant in 2013. I should state that its deadlines have lapsed several times in the past, so there's no guarantee that that will be met. It is also in discussion with several consortia for a utility operator, which are separate negotiations.

Quickly, Turkey has a long history of trying to implement civil nuclear power. By some counts this is its sixth attempt to get a grid connected nuclear power, but this time it looks like it's going ahead. And the principle reason for that is that the financial terms look very good for Turkey. It has signed an agreement with the Russian federation for the construction of four nuclear units at the (inaudible) sites on the Mediterranean coast and Rosatom, the Russian state corporation will finance, build, and operate the plants at (inaudible). And the Turks have agreed to a power purchase agreement for part of the power that will be generated from the site.

Turkey is also looking at nuclear plans in other parts of the country. The most visible of those is the synop site on the Black Sea coast, but it has also expressed interest in the sites near to the Bulgarian boarder. So that's the status of the programs in general. I would refer you to the first year's study for a more detailed examination of the financial approaches that each country is taking, the technology choices, and some of the policy frameworks. The second year of our research as Charlie said, really focused on the issue of human resource development and the reason for that was quite simple.

In our first year of research we found from everybody we spoke to, that the challenge of civil nuclear power really was one that each country shared but as you'll

see, in different ways. We went back the second year with the issue of human resource development as our primary research objective. And the first thing to say I think, is that each country recognizes that human resource development is a serious issue and has plans in place to deal with it. However, I think the bottom line of our research this time around was that there are some serious risks with regard to human resource development that if left unaddressed could negatively affect the viability, the safety, and the sustainability of each of the programs.

And I'll run through the principle issues for concern or risks that we found in each of the three countries and then I'll hand over to John to go through some of the recommendations that our report puts forward to address these issues. The Emirates as I said, is a very well funded and quite a well organized program. It was quite transparent about the way that it was approaching civil nuclear power from the outset, it published a white paper, it engaged in public discourse with its population. Of course the country does not have a fully free press to say the least. But the level of communication and public outreach was exceptional, I think in the Emirates.

We had to really go beyond the public statements and the newspaper headlines to find what was really going on. And I think the first issue that we identified for concern was the way in which the program is matching its workforce development to the requirements of the nuclear program itself and as part of that, the challenge of academic quality control in the institutions that it sets up. The Emirates has shown a demonstrated desire to build a domestic nuclear workforce, but the reality of civil nuclear power is that that workforce has to be trained to a high standard. Nuclear power is a long-term commitment and requires technically proficient people at every part of the chain.

The Emirates has a liking for big projects and high profile programs and initiatives. And one of the dangers that we can see is that there may be a mismatch

between the design of their academic infrastructure and the requirements of the program itself. A nuclear industry rule of thumb suggests that only 20 percent of people working at a civil nuclear power plant need to be educated to degree level and of those only 20 percent. So 20 percent of 20 percent which is 4 percent need a nuclear engineering degree. There are obviously other requirements in the nuclear power plant; power engineers, mechanical engineers, computer engineers.

But the engineers are still the minority of people needed to keep the daily operation of the plant running. The majority of the staff will be vocational staff, technicians and operators and maintenance staff. And in this regard there is, I think, the potential for a gap in the Emirates program. The government has set up what it calls, the Institute for Applied Technology. This is an institute that aims to train vocational staff on a two-year course and is a skills based program. The challenge I think, is attracting students into this program which doesn't have the prestige of an engineering degree. In the course of our research we found that there is a real challenge to get UAE nationals into programs like that.

And even those that are recruited that do sign up, among them we found that there are reasons for concern when it comes to quality control. In at least one program we heard evidence of the curriculum having to be changed because of the attainment level of the students who were enrolled. And so the whole issue of matching requirements and maintaining quality control in institutions that are training vocational staff was the first observation or the first area of concern in the Emirates. The second was quotas.

The UAE has in several strategic sectors, a policy of emiratisation. And this is an effort to ensure that a minimum percentage of UAE nationals are employed in certain sectors. And in theory, this is motivated by sound intentions. The government

wants to channel its human capital into industries where it sees high value, it wants to diversify its economy away from oil and gas into more sustainable, higher value sectors such as technology and services. But UAE is generally struggling with this policy. In some sectors which are private, the employees are choosing to pay fines rather than to meet their quotas of emirate employees simply because there's a mismatch between supply and demand.

The banking sector is an example for this. In a private sector there is that approach, but the nuclear sector is a government controlled area and so there is the possibility to mandate quotas from the government. We found that this is an area for concern. If the government mandates a minimum percentage of UAE nationals in the civil nuclear workforce, you could end up with a situation where you have underqualified or unqualified people in jobs that require qualified staff. And of course this is taking place against a backdrop of a country that is growing very quickly but has many other competing industries for engineers and skilled staff.

I'll quickly run through Jordan and Turkey and I'll hand over to John. The challenges in Jordan and Turkey were very different from those we found in the Emirates. In Jordan, it's a very different country. As you know, bigger, larger skills based, far more established academic infrastructure but nowhere near the level of sovereign wealth that the UAE has. The principle area of concern we found -- well, there were two principle areas of concern we found in Jordan. The first was the level of government commitment and coordination to the nuclear program. The country itself is struggling financially. Earlier this year it got an IMF bailout. And its fiscal situation is leading to a lot of problems economy wide and this is trickling down to the nuclear sector.

So there's the macro picture where the government has a hiring freeze, it has budgetary constraints, and this is really having a knock-on effect in the regulator and

elsewhere. But it's not just a financial problem. The Jordanian approach to implementation of nuclear power was not as well structured as that in the UAE. The country did not put together a white paper in the head of the decision to implement nuclear power as the UAE did and then really approached the whole implementation of nuclear power in a top down technocratic way which is really now coming back to show weaknesses and fragmentation.

There's very little in the way of institutional coordination between different government departments and between the government and other stakeholders. And this really is having a knock-on effect in the ability of the country to put forward a coordinated human resource development strategy. A related issue is that of communication and state (inaudible) involvement. Because of the centralization of the decision making in Jordan, because of the lack of outreach and the lack of consultation with other stakeholders, we're seeing now a very strong backlash from other elements of society; NGO's, the press, other civil society groups, tribal opposition groups.

They're pushing back and this is really having an effect both on the program and on the human resource development strategy. This year this groundswell of opposition made its way to the parliaments where there was a request to suspend the nuclear power program entirely. The proposed site for the nuclear plant has been relocated twice and this really is feeding back to the population and feeding into the ability of the universities in the country to recruit and retain students who want to work in the nuclear power program.

We can get into this in later discussion. But we spoke with some of the leading technical universities in Jordan. We found that five-years ago there was a high level of interest in nuclear power among undergraduates. Now that has really kind of dropped away. That may be for several reasons, but one certainly is the perception of

the program, the perception of nuclear power in general in the minds of would be recruits. Turkey has its own issues; a very different financial model than that going forward in the UAE or Jordan. But when it comes to human resources, there are two principle concerns. The first is what we call, regulator operator asymmetry.

The Russian consortium led by Rosatom has agreed to finance, build, and operate the plant. This is a good deal financially for the Turkish regulator (inaudible) economy, but what that means is that you have a country with no history, no operational history of civil nuclear power playing host to a country that has a lot of history of nuclear, a lot of financial incentive to minimize it's costs, and a brand new reactor design, by the way. The reactor that the Russians are planning to build on the Mediterranean is the VVER 1200. It is not operational anywhere in the world as of today. The Russians are building a plant that will be operational by the time the Turkish plan goes online.

But all of these things add up to a situation in which we see the potential for the regulator to not have the capacity or have insufficient capacity to oversee the Russian consortium that are going to be building and operating the plant. The second area of concern in Turkey relates to the training relationship with Russia. As part of the deal for the first plant, the Russian consortium has agreed to take hundreds of Turkish students to Russia to train them in nuclear engineering. Now, they will get a very rigorous training and education experience in Russia, but we see this as being potentially of concern because it hallows out the Turkish nuclear academic establishment.

It takes the best and the brightest of the Turkish students out of the Turkish system and that in turn will weaken the ability of Turkey to build its own domestic nuclear culture. There are linkages and spillovers that come from having your own training facilities, your own academic programs in country. And for a country like Turkey that is looking at civil nuclear power, not just in terms of the Russian deal but elsewhere,

if it wants to build an indigenous base of skills and expertise, this outsourcing of the training of its nuclear professionals is likely to weaken that ability. So that is in half an hour or 20 minutes a run-through of the main findings of the report. I'll hand over to John Banks to go through some of the recommendations that we resolved at to address some of the challenges I outlined.

MR. BANKS: Well I'll keep this relatively short, just sort of pick out some of the major recommendations that we highlighted based on these risks and challenges that Kevin highlighted so that we can get to some discussion. First, some of these will seem very common sense and very simple but I think it's worth sort of putting them in a single package of recommendations especially if you have other countries looking at implementing their first nuclear reactor outside of the region as well as in the region. First, human resources development really should form the central part of a new nuclear energy state or an aspiring new nuclear energy state from the beginning of it's policy making process.

I mean, governments need to formulate a comprehensive, long-term human resources development plan from the beginning and it has to be done in a transparent and comprehensive way. It needs to be dynamic, it can't be static, it needs to be assessed and monitored as the program is implemented, and it has to be communicated to the public and there has to be a process where they've gone through a workforce planning exercise. What are their current capabilities, what is the basis of the educational system, and what are the requirements for the new technology and the infrastructure that they're putting in place? And in short, it's really not enough to recognize that human resources development is important and to have a plan.

But they really then need to support it politically and financially, which Kevin referred to, it has to be coordinated between government academic institutions as well

as the vendor and the operator, and it has to be dynamic as I mentioned. Now one way to do this is through the public dissemination of a white paper. Kevin mentioned that the UAE had done this from the very beginning. That could include and should include as robust and as comprehensive an HRD plan and approach as possible and that should be communicated. That's just simply one small effort. Small in terms of checking off the list of having a plan and putting it in place and communicating it, but it takes a lot of work.

Second, the human resources strategy for the country needs to emphasize the creation of a safety culture. As Fukushima illustrated, this a major challenge in societies that do not have a tradition of transparency and questioning authority and communicating up through the ranks. The success and sustainability of nuclear programs depend on the kind of operating environment that supports and promotes candidly assessing performance, reporting safety concerns, challenging the status quo, and communicating openly. All of this is critical and should be worked into whatever human resources strategy is implemented. One approach here, we can discuss this a little bit but the UAE has done this, is to utilize a filtering or testing techniques to identify certain aptitudes for workers coming into the workforce.

There are ways to try to identify appropriate aptitudes and psychological profiles, etcetera. Third, to instill the highest performance standards for personnel and human resources strategies really should emphasize merit based recruitment as well as accreditation for academic institutions subject to periodic external review. Very common sense, but it needs to be highlighted and paid attention to right from the very beginning. Another factor is the new nuclear energy states should require the assistance of the vendor operators in capacity building possibly through requirements in the contract that is signed with the vendor or the operator for skills transfer as well as vendor operator input into things like the development of scholarship programs or training programs.

And in fact, each of these countries is doing this. They are looking to include the vendor in skills transfer and training and in their human resources development strategies. Some to different levels, but they're each looking at this as one approach. Fourth and Kevin alluded to this, is stakeholder involvement in public outreach should be a major component of human resources strategy. Now normally as Kevin pointed out, you wouldn't think of stakeholder engagement, public communication, and public outreach as part of HR. But it does have a direct bearing on the implementation of an HR strategy as Kevin talked about and we can get into this a little bit in more detail.

But governments really do need to engage a wide array of stakeholders from the earliest stages of their program to communicate what's going on. And not just in a one-way communication, but in a dialogue. So one of the findings here and one of our recommendations is to really include a robust, comprehensive, transparent, two-way stakeholder engagement strategy as part of human resources development and meeting the goals of your human resources strategy. Fifth, new nuclear energy states should also ensure that sufficient attention and resources are given to building capacity with technicians; those with vocational and operator skills that Kevin mentioned. That's not to say that you should not pay attention to developing nuclear engineering, the higher level professional degrees.

But as Kevin mentioned, most of the workers will be those required with technical skills and that sufficient amount of resources should be dedicated to that, not overemphasize the professional degree programs. And finally for countries implementing new reactor technologies, as Kevin pointed out Turkey is implementing a Russian technology that is not operational anywhere in the world. And one of the two finalists for the Jordanian reactor technology also would be new technology not operating anywhere in the world. More time should be really allowed to develop the indigenous capacity,

particularly in the regulator to avoid this issue of regulator operator asymmetry.

And you know, the IAEA recommends that for countries really starting from scratch that don't have a nuclear skills base, that really you're looking at a 15-year period from the time you decide and embark on a nuclear policy to actually connecting to the grid. Well few of these countries have very aggressive timelines for connecting to the grid short of 15 years. So one of our recommendations is to really look closely at this regulator operator asymmetry particularly with new technologies and make sure that the HR program allows time so that that capacity keeps pace with the development of the program. And just a final comment, you know, emerging market governments looking to nuclear power to support their energy security needs and development needs face some of the same challenges as the industrialized nations did in the 20th century; the same technical and financial challenges.

But clearly, as important for these new aspiring nuclear energy states is this issue of human resources capacity and the need to put in place the appropriate capacity to ensure a safe and reliable program. So what we hope is that some of the factors that we've have pulled out of this review will really contribute some lessons and best practices perhaps for other countries looking to implement civil nuclear power. Obviously there's more detail in recommendations in the report, but we're happy to discuss any aspects of what we've talked about. Thanks.

MR. EBINGER: Thank you, John. We got (inaudible) for a moment. What we'll do now is I'll start out with just a couple questions to the panel. We want primarily to move as quickly as possible for your questions from the floor. While their getting mic, let me formulate my first thought. We have a number of countries in the Middle East, the three that you've concentrated on in your report, to some degree confronting the same kinds of issues and yet you don't hear much talk about, is there a

possibility of cooperation among the various nuclear states. So I mean, if they need to create technical universities and other things, does it really make sense for each to do their own or could there be a regional approach? Could you speak for a moment why it doesn't sound like regional approaches have been very favorably looked upon if that is indeed a fair assessment? Can you surmise why that is?

MR. MASSY: Well while John's getting miced I can take a first cut at that. We did a full literature review before we embarked on this study and several studies had recommended regional approaches to lots of issues whether it was the fuel cycle or human resources development. And so we took that as our point of departure in some of the questions and some of the meetings that we had with the regulators and the government departments and the other NGO's. And we really asked people, how feasible is this? What do you think of regional approaches to human resource development?

The answer for different reasons was, this is good in theory but practically there are very many obstacles to making it work. There are ways in which regional collaboration can work. I think the SESAME program in Jordan which is a technical cooperation agreement throughout the region is an example. But I think that there is a lot of fanfare, a lot of enthusiasm for the concept of regional collaboration. Practically what we heard from these countries is, you know, it's not as easy as it sounds.

MR. BANKS: Yeah, I'd like to make a distinction here. Regional collaboration on the basis of setting up of networks, exchanges, nuclear cooperation agreements, bilateral agreements, things like that is one issue. What we're talking about here -- and that does exist in each of the countries are certainly engaging in those kinds of activities. What we're talking about here is actually sort of the establishment of some sort of physical training center in whatever particular area it might be. And this idea has

been floating around whether it's for to train reactor operators or whether it's fuel cycle issues, etcetera.

But as Kevin said, the response we got was not very enthusiastic. I mean, intuitively it's very attractive. Let's cooperate. You know, we've got similar languages except for Turkey, cultures, regional proximity, etcetera. But the bottom line is for political reasons. I mean there are issues related to -- we heard national security. You know, do we want to open our facilities or have other nationals coming in, for issues of sovereignty, and also financial and proprietary issues. Why would we spend this kind of money establishing a program for our nationals and then open it up for competitive financial proprietary reasons?

So we heard a lot of sort of, yep, it's a great idea but how are we really going to make this work. And so the conclusion we have in here is not that we're sort of dismissing this as an option, but I don't think the HR strategy of country should really have this as a major cornerstone to rely on. It really should be more of a complementary or other issue. Don't get drawn into dedicating a lot of time and resources to this. Don't make it a major pillar of your strategy.

MR. EBINGER: If you had to highlight two or three similarities and differences among the different countries that you examined and say why one approach was better than the other, what would you say?

MR. MASSY: Well you know, I think we identify several things that the UAE is doing well, but it can afford to do those things well. It has the ability to set up a dedicated technician training school. It has ability to buy in the best expatriate expertise on the market. So in one respect the UAE has the luxury of buying best practice. But in other respects, I think the UAE is doing things that are not dependant on its level of sovereign wealth. It set up an independent regulator. Now how independent the

regulator, we are not equipped to evaluate as far as I can see. But they have XNRC staff, XIEA people. Turkey does not have an independent regulator. Its regulator reports directly to the Ministry of Energy and Natural Resources.

It published a white paper ahead of its decision to go ahead with the nuclear power. So I think there are several aspects and elements of what the UAE is doing that are good practice and could serve as lessons to others. As I noted in my remarks, the UAE has its own challenges and it has areas where it could certainly improve, but I think for a country looking at civil nuclear power as a brand new prospect that they could learn quite a lot from what the UAE has done.

MR. BANKS: Well on the UAE I would just add one comment. We did hear a comment from an individual well-connected and well-knowledgeable in this area broadly as well as knowledgeable in the UAE program, questioning whether or not the UAE is a model for other countries and whether this is some sort of a standard that other countries can look to. And I think you know, Kevin has highlighted they just simply have the financial bandwidth to buy the expertise and to set up these institutions. So whether or not this is replicable, any parts of it -- I mean you could say that some of the approaches for example, they are dedicating some resources to that vocational training aspect which is good.

The other countries could look to, but that costs money. That takes resources. So the question is, is this a replicable approach for other countries. And we heard one comment as I said, from someone knowledgeable of the program and of this subject generally that it's not. It could be just sort of a one off approach to HR issues. Now if the Saudis start to develop a nuclear program, are they in the same category as financial bandwidth as the UAE? Probably, but that doesn't mean they'll pursue the same path. So I would be just cautious about those who might think that there are

elements of the UAE program that structurally are sound, but financially may not be replicable elsewhere.

MR. EBINGER: Let's move to the floor. We'll be glad to -- yes, sir?

MR. WILSON: Tracy Wilson from the Pacific Northwest National Laboratory. Thanks for your comments and thanks for a very thoughtful and logical report. Two questions for you. In your surveys, interviews, analysis, did you sense any impact from the U.S. government programs that are in place to do capacity building in this area, in this region and elsewhere around the world? And then second question, is there a role for the nuclear industry at large in this area to ensure success for these programs?

MR. BANKS: Well I would say on the first question, yes. And I think that you know, all of the countries are similar in that part of the strategy is to look externally for assistance whether that's to the IAEA, whether that's to nuclear cooperation agreements, bilateral agreements with other countries, and certainly the expertise that the U.S. has plays a prominent role. I can't say that we specifically heard of a specific U.S. program, but the fact that you have former NRC officials working in the UAE -- I know that the UAE and the NRC have had exchanges for example. So, yes. I mean the U.S. and the U.S. regulatory system in particular is looked to as a sort of gold standard most certainly. And I know Jordan and the U.S. are working on collaboration as well. They're still talking about that. So yes, I think there's a general recognition that the U.S. has quite a bit to offer.

MR. MASSY: Yeah, one program that comes to mind is the GNEII program in the UAE which is being run in partnership with Sandia National Labs. And in the course of our study we did involve representatives from the GNEII program both on the Khalifia University side and Sandia Lab side. Both programs are valuable. They get

the talent and the knowledge from the U.S. into the region. There was some less enthusiastic -- there was some evidence of lack of enthusiasm for those programs from some quarters. It seems that like I said, that there is a desire to sign agreements to have opening ceremonies and inauguration events that tail off when the actual substance of the agreement has to be executed.

With the GNEII program I think there is a view that that may be one of the programs that is a lot more -- or had a lot of fanfare at the outset is of limited value in an ongoing basis. And then -- sorry, the issue of the international community. As John said, each of the programs we have -- each of the countries that we visited in this research all emphasize the value of the IAEA in designing the human resource development program. So I think the (inaudible) national community really is served through what the IAEA does.

MR. WILSON: I wasn't clear. I was asking you about the nuclear industry --

MR. MASSY: Oh.

MR. WILSON: -- at large in ensuring the success of these programs.

MR. BANKS: Well absolutely and I think the countries -- the representatives of the programs that we talked to certainly recognize that. I mean, there's all manner of not just these nuclear formal sort of, bilateral ceremonies and nuclear cooperation agreements, but these sort of networking arrangements. I know that the European Union is sponsoring a -- I forget the formal name of it. It's a regulator network essentially where they bring together expertise from various regulators and nuclear (inaudible) in Europe and have them visit countries. Jordan was actually the kickoff case where they come in and sort of do an assessment of the regulatory regime, you know, sort of give them a status report of what they could be doing better and what

kind of assistance they could look for.

So all the countries are really looking at those kinds of scholarships, etcetera as well as what I mentioned in terms of the vendor arrangements. They're all very cognizant of getting the vendors more involved in skills transfer, scholarship programs, and other training. Very aware of it and very keen on it.

MR. EBINGER: (inaudible) in the back.

SPEAKER: I'm Helen Raffel with Resources for the Future. I have three very quick questions. The first is, is the development -- particularly with respect to the UAE, is the development of nuclear more advantageous for them than the development of solar? I think of them as you know, like Saudi Arabia in the sunshine all the time. And my second question, perhaps I'm misinformed, but I thought that the whole Arabian Peninsula depends a great deal on energy for desalinization of water because they're so water short.

So that is particularly important for them in the long run to have seamless, perhaps overcapacity for energy development. My third question is for the UAE again. I don't know what the terrain is like, but are they likely to be under water as with the rising of the ocean with global warming even before they come to the point of needing the longer-term energy that the carbon resources can't supply?

MR. MASSY: The UAE does have a lot of sun. It has a very aggressive program for -- Abu Dhabi which is really leading the energy kind of, the forward-thinking energy policy of the Emirates in general, has --

SPEAKER: (off mic).

MR. MASSY: I'm sorry? Well, so they recognize they have a lot of solar power. They are implementing many programs to try and harness that energy. They realize the need for base load power and if you look at the growth rates of the economy

and the growth of demand, the Emirates itself is going to need 40 gigawatts of electricity capacity by the end of this decade. Solar is just not going to be able to meet that in the timeframe that they expect that demand to come on. So solar has been considered, but nuclear is near-term, highly scalable, highly reliable source of power generation and so that's why it's going with that option.

Desalination, yes, we acknowledge that in the report that one of the reasons it requires so much electricity is to serve its water needs. And as for the Emirates being -- or the Arabian Peninsula being under water, I'm not seeing any projections that suggests that is a danger.

SPEAKER: (off mic) Fukushima problem with the rising of the water and possible --

MR. MASSY: The bigger problem has been lack of water. They have to site these plants to access the cooling water and so that hasn't really been a factor in our research.

MR. EBINGER: The lady in the back. I'll get to you.

SPEAKER: Thank you. (inaudible) from the Center for Nonproliferation Studies. One of the -- and all of you mentioned --

MR. EBINGER: Is the mic on? We can't hear you?

SPEAKER: It's on.

SPEAKER: One of the referral sort of organization that you all have mentioned is the IEA and one of the benchmark that were not mentioned by the IEA for newcomers is research reactors. In some countries in the region have some research reactors while the UAE decided purposely not to pursue the research reactor. So my question for you is, how did you look at this issue? And especially for human resources development, that's going to be given first before you build the 30 sort of stages building,

maybe you'll practice with something smaller. So it would be very important. But did you look at why they decided not to and how the decision in Jordan maybe influenced the HR development as well?

MR. BANKS: Well, we looked at the question of the research reactor from a couple of standpoints. One is the regional collaboration standpoint. Turkey has a research reactor. Jordan has actually committed to building one as the Jordanian University of Science and Technology in Irbid. So it factored into the question about whether the existing facility for example, in Turkey and the eventual research reactor in Jordan would comprise a facility that could be used for shared regional training. But as we've addressed, the regional training issue is something we don't believe should form a cornerstone and then that particularly gets to the issue of sovereignty and national security issues.

You know, do you want to open the research reactor to other nationals, how is that managed? There are programs that don't allow nationals to participate in a nuclear program. So there are issues related to -- the sorts of political issues that are related to constraining the use of either existing or future research reactors. You know, Jordan is committed to building this research reactor at just the Jordanian University of Science and Technology for its own nationals. I'm not sure if they commented to us whether they would open up to other nationals or not, but the idea is they want that to compliment their academic structure.

You know, they've started a new undergraduate degree in nuclear engineering in 2007 and have ramped up pretty well and have some very high quality candidates that are going through that program and they want that research reactor to compliment that degree program on campus.

MR. MASSY: And just to add to that, I think the Emirates want the power

as soon as they can get it. And whatever the shortest line between here and grid connected nuclear power is -- I think it will take and a research reactor I think was beyond it's -- would have taken the program on a detour. And just to John's point, Turkey's research reactor, I traveled to several of the universities in Turkey and asked them about how feasible it was to get access to the research reactor which is at Istanbul Technical University. And even students at other universities had to (inaudible) university and others in Turkey can't get time or access to their own research reactor. So the idea of a research reactor as a regional international training asset looks unlikely if they can't use it domestically.

MR. EBINGER: Sir?

SPEAKER: (inaudible) from the International Center of (inaudible) Studies. I have two questions about Jordan. First, you mentioned some opposition from various groups, tribes, and NGO's to the nuclear program but on a larger scale there's a lot of growing political instability in Jordan from these groups. How is that influencing the overall nuclear program? Secondly, Jordan is the one Middle Eastern state that supposedly has a large uranium resource. Have you looked into human resources needed to develop the uranium resource mining and processing of the uranium?

MR. BANKS: Yeah, the first question, that's a good question. As you all know, there's a lot going on in Jordan politically and economically beyond nuclear energy. I mean, as Kevin alluded to they are in very dire economic straits, they import well over 95 percent of their energy, they get a lot of gas -- they used to get a lot of gas from the Arab gas pipeline via Egypt, that's been shut down so now they're going in the world market and buying fuel (inaudible) for the power sector. So they have got a serious debt deficit problem and as Kevin mentioned, budgetary constraints and that is filtering down into the nuclear sector.

Jordanian nuclear regulator has a very detailed workforce plan, but they don't have the budget resources to meet the workforce needs. And they have raised this issue but it's a serious problem. So you've got this economic sort of instability going on and at the same time you've got Fukushima and the whole Arab awakening throughout the Middle East where you've got a lot more vocal parts of the population criticizing the government, challenging authority, challenging decisions across various sectors. And that is contributing to some of the nuclear -- it's trickling down into the nuclear area. Now importantly combined with this is the lack of a really robust stakeholder engagement strategy. The Jordanians have come late to realize how important this is.

So think about what's happening. You've got this economic instability and then you've got this sort of rise of the civil society questioning the government and raising questions about the nuclear program and the government has not kept pace and has not been very adept at answering those questions about the nuclear program. And this has fostered this atmosphere of -- this really adversarial and confrontational atmosphere and added fuel to the fire. And think about that from a human resources standpoint. If you're a young professional choosing an engineering degree, you know, in this environment does nuclear engineering look like something you want to commit to for the next five years? And we did hear evidence that that was impacting students' decisions to pursue this career.

MR. MASSY: And just to follow up on that and answer your second question, an aspect of this mistrust has been around the size of the uranium resource base. A lot of the early justification for the program and a lot of the projected financial kind of ability to finance the program came from a very high estimate of the uranium resources in Jordan. Their government said that it could use revenues from sale of the uranium to finance it. Those estimates have been revised downwards, constantly

downwards and that has led to a level of increasing mistrust. The population thinks it's being told a bill of goods when it comes to how much uranium it has and how much the uranium sales and revenue can offset the cost of the program.

And so there is a kind of a set of linkages here that adds to a sense of mistrust of pushback against a government that is seen as railroading this nuclear policy through at a time when the region is kind of going in another direction when it comes to civil society and an opposition to technocratic talk down decision making.

MR. EBINGER: If I may add just one point to that, it's also quite interesting that Prince Hassan, you know, King Hussein's younger son is now in the forefront of the antinuclear opposition and he is also a very strong advocate for pushing renewable energy rather than nukes in the kingdom. So that's another dynamic since the prince is often more popular according to many political observers than the king is.

MR. BANKS: And one final comment on this. The Jordanian government has recently I think, recognized the seriousness of the need for this more comprehensive and transparent public outreach. They did an analysis with the IAEA on lessons from Fukushima for the Jordan program and one of the issues that came up was the issue of public communication and transparency in public outreach in responding to public concerns. So whether it's too late to the game to inform the public and move forward, it remains to be seen but it's a critical issue.

MR EBINGER: We're running out of time but we will take a couple more and then try to give quick questions and quick answers.

SPEAKER: Jim (inaudible) nuclear (inaudible). You have expressed concern about the basically HR development programs, particularly in Jordan and Turkey. But say nuclear power in fact goes online; somehow the governments manage to do that. What is the concern in terms -- operationally and from a proliferation

standpoint if you have reactors operating in these countries and the needed development you talked about is really scanty or not there at all?

MR. MASSY: Well I think the answer to that is Fukushima. I mean, the Japanese nuclear program was run by some of the most technically able engineers in the world in a country known for its technical aptitude. And you can see what happens when there is a breakdown in communications and a less than transparent culture of operational safety and accountability. So if Fukushima could happen in the context of Japan, an industrialized nation with decades of experience in nuclear power, I think the risks for newcomers are self evident.

SPEAKER: (inaudible) on proliferation if that is a heightened issue.

MR. MASSY: Well as you know, the UAE has signed an agreement to force (inaudible) and reprocessing; Jordan hasn't. I think the risks with regard to proliferation are similar to those with regard to operational safety. I mean, if you have weaknesses in the professional culture, lack of attention to high standards of operation, you've run the risk of accidents and vulnerabilities.

MR. BANKS: We didn't call out specifically a proliferation set of human resource skills. I think we lump that in with the broad category of safety culture. The concept of safety culture and nonproliferation needs to be incorporated into the overall HR strategy. So while you don't see that word called out specifically, I think we lump that in with the broad safety culture that needs to be incorporated as part of the HR strategy.

MR. EBINGER: All right. We have a very patient lady back here who's -
- we'll make hers the last word.

SPEAKER: My name is (inaudible). My question is about America University (inaudible) New York University. They're building branch campuses in Middle East and what kind of role they're going to play in the future?

MR. MASSY: Well I think the presence of these universities in the region will bring faculty and expertise from the U.S. and from other western countries. I think it has the potential to address some of these challenges. In the UAE the (inaudible) has been to try to create its own institutions, its own (inaudible) institutions, the Khalifia University being the kind of flagship program. A lot of the western universities have gone to Qatar. That has really been the magnet for a lot of these branch campuses. I think there is an opportunity for these to be used to address some of the gaps in training and education. But at the moment, that doesn't seem to be -- there seems to be more of an appetite on the part of these countries to create their own institutions than to partner with branches of established western universities.

MR. EBINGER: Well, I want to thank our panelists and our audience for a very interesting discussion. Thank you very much.

MR. BANKS: Thank you.

MR. EBINGER: Thank you for coming.

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