

# Prospects for Nuclear in Puerto Rico and the Pacific Northwest

NARUC-DOE Nuclear Energy Partnership FRIDAY, AUGUST 6, 2021 2:00 – 3:00PM ET

### WELCOME

- Commissioner Anthony O'Donnell, Maryland Public Service Commission, Partnership Co-Chair
- Commissioner Kimberly Duffley, North Carolina Utilities Commission



# NARUC-DOE NUCLEAR ENERGY PARTNERSHIP

- Launched in March 2021 with support from the U.S. Department of Energy Office of Nuclear Energy
- An educational partnership that provides opportunities for state public service commissioners and commission staff to better understand barriers and possibilities related to the U.S. nuclear fleet, the nation's largest source of zerocarbon power
- Includes commissions and commission staff representing 20 states and territories
- Associate members from the Coalition for Advanced Reactor Solutions, University of Michigan Nuclear Engineering and Radiological Sciences



#### PANELISTS

- Jesus M. Nunez, PE, Director of the Board and CEO, Nuclear Alternative Project
- Arne Olson, Senior Partner, E3





Presentation for NARUC August 6, 2021

Jesus M Nunez

Chief Executive Officer NAP

### <u>AGENDA</u>

- 1. WHO WE ARE?
- 2. OUR WORK
- 3. FEASIBILITY STUDY FIRST STEPS
- 4. RESULTS FROM OUR FEASIBILITY STUDY
- 5. CURRENT & FUTURE PROJECTS
- 6. CONCLUDING REMARKS



#### WHO WE ARE?

- Our Mission to study the alternative of advanced reactors for Puerto Rico and resource-limited countries by educating communities and their governments about their technological advances.
- Our Approach We adopted a strong community engagement approach. We are educating the communities first about advanced nuclear reactors and trusting that this transparent way of communication will result on an acceptance of a future advance nuclear reactor project.



#### NAP LEADERSHIP TEAM





Jesus Nunez Chief Executive Officer

- Bechtel Sr. Structural Engineer
- 13 yrs in Nuclear Structural Design

VALERIE LUGO Chief Operations Officer

• 17 yrs Entrepreneur and HR Operations



RAMON MARTINEZ Chief Nuclear Officer

- INPO Director
- 21 yrs in Nuclear Operations, Engineering and Maintenance

ANGEL REYES Chief Technology Officer Exelon – SRO/STA

• 13 yrs Nuclear Engineering and Operations





#### NAP VOLUNTEERS & ADVISORY BOARD

- NAP volunteers give their time and expertise to our organization. They are an important part of NAP's structure. Our current volunteers are engineers and other professionals with various experience in the U.S. nuclear industry.
- NAP advisory board provide direction and recommend action plans to our leaders in a timely basis. They are formed by a group of engineers and other professionals with an intensive knowledge of the U.S. nuclear industry.



#### HOW EVERYTHING STARTED

NAP was founded in late 2015 by a group of Puerto Rican engineers working in the US nuclear industry. It started with a question...

How is it that no one is talking about advanced nuclear reactors to help solve Puerto Rico's energy problems?





"If you have an opportunity to accomplish something that will make things better for someone coming behind you, and you don't do that, you are wasting your time on this earth". *Roberto Clemente 1971.* 



Figure. Roberto Clemente photo from: www.Britannica.com/biography/Roberto -Clemente. Accessed 2/21/2021. THE NUCLEAR ALTERNATIVE PROJECT

#### OUR WORK

- NAP brings Puerto Rican engineers and other professionals within the U.S. nuclear industry to study the market viability, safety and environmental impact of advanced reactors in Puerto Rico.
- NAP efforts centers on the idea that as we do our work, we engage and inform the community in Puerto Rico and U.S. key stakeholders through the process.
- The NAP action model sets the foundation for future project development and local skills development. We believe this is foundational for future sustainable development of advanced reactors in Puerto Rico.



## NAP-WHAT WE DO







#### Importance of Public Opinion



From NEI Fall 2016 National Public Opinion Tracking Survey Memo

- NAP brought the discussion of SMR's and Microreactors to Puerto Rico by integrating the community, nuclear industry, local leaders and interested stakeholders.
- NAP leadership engaged with local media during the process answering technical questions and noting that some of these questions needed further studies.
- State Legislature passed Resolution 1189 to officially evaluate SMRs for Puerto Rico.







- NAP participated on public hearings for resolution 1189.
- NAP gathered feedback from the community, local leaders and interested stakeholders about the most important topics which needed further studies.
- Puerto Rico Energy Bureau provided a letter to our organization demonstrating interest in results of the feasibility study.
- NAP submitted an unsolicited proposal for a feasibility study to the DOE-NE.









Vice President Strategy and





# **RESULTS FROM OUR WORK**

- Feasibility Study for Small Modular Reactors and Microreactors for Puerto Rico
  - Market conditions in Puerto Rico
  - Technology assessment
  - Public perception
  - Grid assessment
  - Legal and regulatory framework
  - Financing, ownership and operation mechanisms
  - Weighing the benefits and challenges for Puerto Rico

This study indicates that development of advanced nuclear reactors in Puerto Rico is feasible.





 Aging power plants cause unplanned outages 12x more than US plants. Expected retirement of 13 older plants within 10 years (3,600 MW)





Images from Puerto Rico Electric Power Authority



Puerto Rico Renewable Portfolio Standard Mandates:

- Puerto Rico stable electricity demand requires steady baseload less suitable for intermittent renewable sources
- Only nuclear reactors can complement the intermittency of renewable power sources with zero-emission baseload power generation.
- However, PR Renewable Portfolio Standard requires 100% renewables by 2050





- As part of this study, over 3,000 residents of all ages and educational backgrounds were surveyed around the island.
  - 94% of the residents are interested in continuing to explore the option of nuclear energy for Puerto Rico
  - Residents rated their top priorities for power generation options as:
    - 1. impact to health and environment
    - 2. lower electricity bills
    - 3. resistance to natural disasters.



THE NUCLEAR ALTERNATIVE

PROJECT

Advanced nuclear reactors can promote smaller and more distributed future generation plants. SMR installed capacity range from 50 MW to 600 MW and Microreactors range from 1 MW to 20 MW, which makes them all suitable with Puerto Rico's decentralized grid vision, particularly minigrids.





Westinghouse eVinci Microreactor

NuScale SMR Building

### Key Feasibility Study Conclusions

 The delivery of electricity from SMRs and Microreactors can be cost competitive when compared with natural gas generation from mobile gas units and CCGT units proposed by PREPA as part of the Island's fleet replacement.







Images from Puerto Rico Electric Power Authority

#### MAIN CONCERNS

- Spent Nuclear Fuel Disposal
- Hurricane and Earthquake Resilience
- High cost of new nuclear projects
- Why is nuclear needed vs wind/solar?
- What if there is an accident?



### **CURRENT & FUTURE PROJECTS**

- Site Suitability Proposal submitted to U.S. DOE FOA program for a Site Suitability study for SMR's and Microreactors in Puerto Rico per U.S. NRC Reg. Guide 4.7 for two regions shown previously.
- Input will be obtained from INDUNIV members and U.S nuclear reactor vendors.



U.S. NUCLEAR REGULATORY COMMISSION OFFICE OF NUCLEAR REGULATORY RESEARCH **REGULATORY GUIDE**  March 2014 Revision 3 Technical Lead Jacob Philip

REGULATORY GUIDE 4.7 (Draft was issued as DG-4021 on December 30, 2011)

#### GENERAL SITE SUITABILITY CRITERIA FOR NUCLEAR POWER STATIONS



#### **CURRENT & FUTURE PROJECTS**

#### A fully integrated approach to site suitability.

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January 28, 2019	Presidente de la Comisión de Calendarios y Regite Especiales	Secretary Tele Seather Johnnen B Johnnen	Chief Operating Officer The Nuclear Alternative Proj	Teva Puerto Rico LLC P. O. Box 1005	February 24, 2020	westinghouse	Valerie Lugo		Devid 1. Sindulk Senior Vice President, Sans / Jaint Vereure Ablance Lander
	February 24, 2020	Towner Gustere Hermide CIC Centeraction Georg	Sugar Land, TX 77479	Fajardo, PR 00738-1005	Ms. Valerie Lugo The Nuclear Alternative Project (NAP)		The Nuclear Alternative Project Inc. 5826 New Territory Bird #1038	June 12, 2020	BRDS Carter Heyne Road, M/C AND Witnington, NC 25405
Eddie M. Guerra, P.E. The Nuclear Alternative Project Inc	Ms. Valerie Lugo	Jose E. Vidal Paul Predident	Ms. Lugo,	Date: February 21, 2020	Subject: Commitment Letter for Cost Sh	Valetie Lugo C Chief Operations Officer r	Sugar Land, Texas 77479 USA	Valerie Lugo	T +1-800-208-4538 C +1-800-547-234
9018 Carriage Point Dr Sugar Land, TX 77479	The Nuclear Alternative Project	Manuel Laber-Vister Mercol DDBC /FEDCO	The pharmacentical and medi crossroads and energy reliabi	Ms. Valerie Lugo Chief Operating Officer	Project, Phase 2 of the Puerto Rico SMR DOE FOA-0001817.	Nuclear Alternative Project 5526 New Territory Bird #1036	Subject: Letter of lotent regarding the Nuclear Alt	Chief Operations Officer The Nuclear Alternative Project Inc.	denia siessi in Ogensone
Dane Mr. Guarra	Sugar Land, TX 77479	Lacy Crupe - E. Varela PRESTE Trust	constitutes the most vibrant is industry sector that represent seek alternative sources of en	The Nuclear Alternative Project 5826 New Territory	Dear Ms. Lugo,	USA	Dear Ms. Luco:	SIG6 New Territory Bind #1038 Sugar Land, Texas 77479 USA	
Further to our conversations with	varene gunt tearaneman veproject org	Wanda Maldenado UPR Healthuare Council	with the potential to address a	Bivd #1038 Sugar Land, TX 77479 valerie@nuclearaltemativeproject.org	NuScale Power is pleased to provide this or SMR & Micro-reactor Feasibility Study," pro	Collision I associate and association of a second of the second	X-energy would like to express its intent to supp	Subject: Letter of commitment in support of the propos	al from the Nuclear Alternative Project for the
(NAP) with respect to an unsolicit study the feasibility of advanced r	Dear Ms. Lugo,	Hassa Cebolaro Pfaur Sandra Boleigon	NAP and DoE on Jamary 27 providing Poarto Rico the op	Dear Ma Luna	(DOE) Fiscal Year 2020 announcement DE proposal to move forward with the feasibility	Project for the second phase of a feasibility study on the reactor and micro-reactor technologies in Paerto Rico	proposal it is planning to submit to the U.S. Depart "U.S. Industry Opportunities for Advanced Nucle	second phase of a feasibility study on the depic technologies in Paerto Rico	yment of small modular reactor and micro-reactor
As part of our mission, the PREB is	Congratulations on the results of the Phase 1 of your Feasibility Stor see that the people of Paerto Rico are receptive to this new energy alte	Abdillen Jaan fant Abbile	fuel diversification. The Phan group to better understand the that the collaboration between	It is the interest of the TEVA Fajardo P.R. site managemen	Commission (USNRC) regulations.	Dear Ms. Luge:	deployment of small modular reactor and micro-re	Dear Ms. Lago,	
timely and reliable information or energy, whether by using fossil fue	I want any houses that Black 2 of your study will be exceeded by	Jensica Sanjunjo Lilly Caribo	bring great things, improving	Nuclear Technology Development Project by donating our time data in Phase 2 development. As a third party contributor we	Our unique SMR technology offers a new le suited for Puerto Rico. NuScale is currently	Westinghouse would like to express its upport for the proposal t is planning to solutil to the U.S. Department of Energy Fur Industry, Constitution for Advanced Neular Techniquer, D	X-energy is the promoter, owner and developer of ting associated technologies including TRISO fuel.	GE Hitachi would like to express its support for the propos planning to submit to the U.S. Department of Energy Fund	al that the Nuclear Alternative Project (NAP) is ing Opportunity Announcement, "U.S. Industry
and reliable information includes advances have led to the design of r	Resolution and Public Hearings on this topic, we need Phase 2 to run an	Malla Garris- C. Martinet Avan Geind Quiles	group, we encourage the appr NAP will evaluate the econot	a total of \$ 10,000 to share the costs of data collection n viability of this project.	undergoing USNRC design certification rev development, testing and licensing, our SM	porposal seeks to complete the second phase of a famibility st reactor and micro-seactor technologies in Paseto Rico.	Should the proposal be successful, X-energy will contribution not to exceed \$30,000. This in-kind co	opportunities for Advanced Nuclear Technology Developer complete the second phase of a feasibility study on the de technologies in Road Size	ent" (DE-FOA-0001817). The proposal seeks to ployment of small modular reactor and micro-reactor
This letter does not represent an e	2 of your study. I also plan to schedule the public hearings for Resolu	RD Hunderson Millie Einen Merch & Co.	to deploy advanced reactors. scenario that could suppleme educational strategy.	Keep up the good work and please advise if you need anythin this project	will culminate in a Final Safety Evaluation R	Westinghouse is currently developing the eVinci <sup>244</sup> Micro-Reac market consisting of remote communities, remote mines, or	cr. to addressing requests for information received fr tics on the proposal but prefer our company name be a	GE Hitachi is currently developing the BWRX-300, a 300Mi	Wwater-cooled, natural circulation design with passive
mission to gather and analyze in technologies and their potential to	study.	Miguel Pervice Bayw	The Industry University Rese 501c3 commission could not	and project.	NuScale is committed to providing up to \$4	Westinghouse has a keep interest in exploring the potential of cit Reacter, including the distributed energy needs of islands on porposed by NAP therefore aligns well with the interest of We	22 a additional information, please do not hesitate to co b a tip	safety systems. It is the tenth evolution of our boiling wate since GE began developing reactors in 1955. The BWRX-30	r reactor and is the simplest, most innovative design 0% low cost, that is competitive with natural gas and
We wish you well in your propo	I am sure you are already allocating your resources and efforts on this, to keep the conversation and achieve a greater understanding of the ge	Lana Grades UB/07 Carlos Eroro Veles	medical device cluster in Pas and yield concrete, reliable at	Sincerely,	hours as needed to respond to information commitment is subject to the availability of it	the development of advanced micro-reactor technology. Should the response he movement Wastingtones will be willing	Sincarely,	other renewables, and it's small, compact footprint makes Should the proposal be successful. GE Hitachi will be willin	It an ideal solution for Puerto Rico.
Regards	of using this type of power generation.	Toroid Techno Velifietion & Eng. Group	Keep up the good work and p	Approved by:	We are excited by the groundbreaking work with you to bring clean reliable energy to PL	contribution not to enceed \$37,000. This in-kind contribution hours dedicated to addressing requests for information received	to Aff Baryer	not to exceed \$45,000 USD. This in-kind contribution will b addressing requests for information received from the pro	e in the form of engineering labor hours dedicated to ject team.
MAK	Keep up the good work and please let us know if you need anything for assist on this study.	Carlos Crines Principia Base Di Cristina	Sincerely,	Allow and		We wish the NAP term success on the proposal. Should you a not hesitate to contact me.	ed: Jeffrey Harper Vice President, Business Development & Strategy	We wish the NAP team success on the proposal. Should yo benitsta to contact me	u need any additional information, please do not
Edison Antes Bella Chairmian	Sincerely,	BLDM Liffy Rodrigues VOCES	Patro	Hector J. Rivera Juan Polanco	Best Regards, N. Reye, Ja	Sincerely,	X Energy, LLC Jharper@x-energy.com (301) 641.7906	If you have any questions, please feel free to contact me at	t your convenience.
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#### COMMUNITY + INDUSTRY + GOVERNMENT + TECHNOLOGY



## **CURRENT & FUTURE PROJECTS**

#### Nuclear Energy in the States: Webinar



Live webinar and Q&A Presented by Christine Csizmadia

Christine Csizmadia, Presenter Director, State Governmental Affairs & Advocacy, Nuclear Energy Institute (NEI)

Descripción General Sobre la Gestión del Combustible Nuclear Gastado y Residuos Radiactivos de Alto Nivel



7:00 pm EST

Webinar en vivo Presentado por:

Evaristo J. "Tito" Bonano, Ph.D. Gerente Senior, Ciclo del Combustible de Energía Nuclear Sandia National Laboratories

Evaristo presentará una descripción general del ciclo de combustible de energía nuclear y las consideraciones para gestionar y eliminar de forma segura el combustible nuclear gastado y los residuos radiactivos de alto nivel. El seminario web también discutirá temas de investigación v desarrollo que se están realizando con relación al almacenamiento, transporte v eliminación del combustible gastado y residuos radioactivos.



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THE NUCLEAR

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#### Introduction to Nuclear Energy Webinar

January 28, 2021 7:00 pm EST

Live webinar Presented by Erik Cothron with Q&A

Erik Cothron, Presenter Senior Energy Consultant, Guidehouse

#### NuScale SMR Nuclear Technology Webinar

December 8th, 2020 8:00 pm EST

Live webinar Presented by Dr. Jose Reyes with Q&A

Dr. Jose Reves. Presenter Chief Technology Officer and Cofounder, NuScale

Jesus M. Nunez. Moderator Chief Executive Officer and Cofounder. The Nuclear Alternative Project

Dr. Jose Reyes will introduce NuScale SMR Nuclear Technology. The webinar will focus on the following topics: General NuScale Plant Operation, NuScale's ability to integrate with renewables, NuScale Plant Resiliency, Used Fuel Management, Job creation from NuScale Nuclear Technology implementation.





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PROJECT



NUSCALE

e electric power al nuclear power







## **CONCLUDING REMARKS**

- A strong community engagement approach at the conceptual phase of a potential project is essential, specially for countries or states without previous nuclear energy operating plants. This is the importance of public opinion which is critical in Puerto Rico.
- Communities need to be educated in a transparent way about the benefits and challenges of a potential nuclear energy project.
- Technical or general questions from the community should be answered in a timely manner to avoid misinformation.



### **CONCLUDING REMARKS**

- Local culture and politics are important variables to consider during the conceptual phase of a potential project.
- Energy resiliency and reliability are important variables to consider during the planning process of energy assets selection. This is specially important if we are dealing with heavy manufacturing and critical infrastructure. Puerto Rico's economy depends highly on heavy manufacturing.
- Countries and states should select an energy asset mix which optimizes the cost of electricity, resilience, reliability and it's scalable in case of a potential energy demand increase.



#### **CONCLUDING REMARKS**

 A fully integrated approach between community, industry, government and technologies is essential to bring interest to a potential nuclear energy project.



#### **GRACIAS!**





### CONTACT US

- Visit our website and social media
- https://www.nuclearalternativeproject.org/get-involved
- https://www.facebook.com/nuclearalternativeproject
- https://www.twitter.com/projectonap
- https://www.linkedin.com/company/22312909/
- Download our Feasibility Study Report
- Donate at our website



### **UPCOMING PARTNERSHIP WEBINARS**

- September 10, 2021 Quarterly Partnership meeting, *members only*
- October 8, 2021 Compensating carbon-free power

#### naruc.org/cpi-1/energy-infrastructure-modernization/nuclear-energy



# **THANK YOU**

Chair Tim Echols, Georgia

Chair Anthony O'Donnell, Maryland

NARUC staff supporting the Partnership:

- Jasmine McAdams, <u>jmcadams@naruc.org</u>
- Kiera Zitelman, <u>kzitelman@naruc.org</u>

