

# The Benefits of a Nuclear Project: A Westinghouse Perspective

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October 2017  
INAC 2017  
Belo Horizonte, Brazil



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# Why Nuclear Power

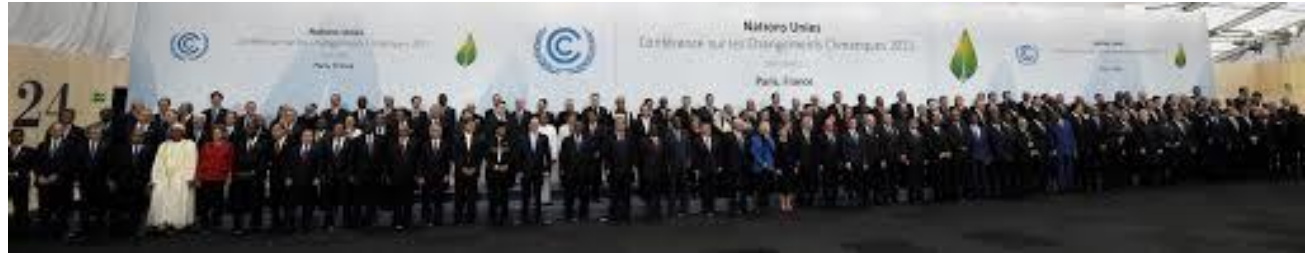
**7.6 Billion**  
**2017 World Population**

**1 Billion Live on** **750 Million Lack** **1.3 Billion lack**  
**Less than** **access to** **access to**  
**US\$1.25/day** **clean water** **electricity**

Access to reliable and clean electricity is an imperative to our future: Nuclear Power has a Important Role to Play



# COP21



- The International Energy Agency (IEA) projects that, ***in order to meet any desired emissions goals, the share of nuclear energy in global electricity production needs to rise from about 400 GW to 1,000 GW by 2050***, producing about 9 trillion kWhs/year, at a construction cost of about \$8 trillion. This also assumes wind and solar reach about 2,000 GW each, producing a combined 10 trillion kWhs/year, over the same time period, at a construction cost of about \$20 trillion.

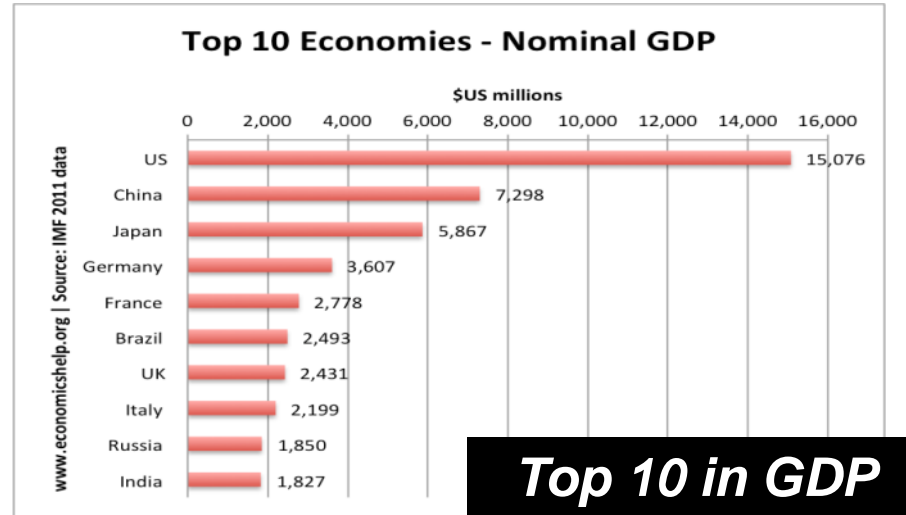
**Nuclear Power is an essential part of the clean global energy mix**

# Brazil's Unique Position in the World Today



**193.946.886**

**Top 10 in Population**

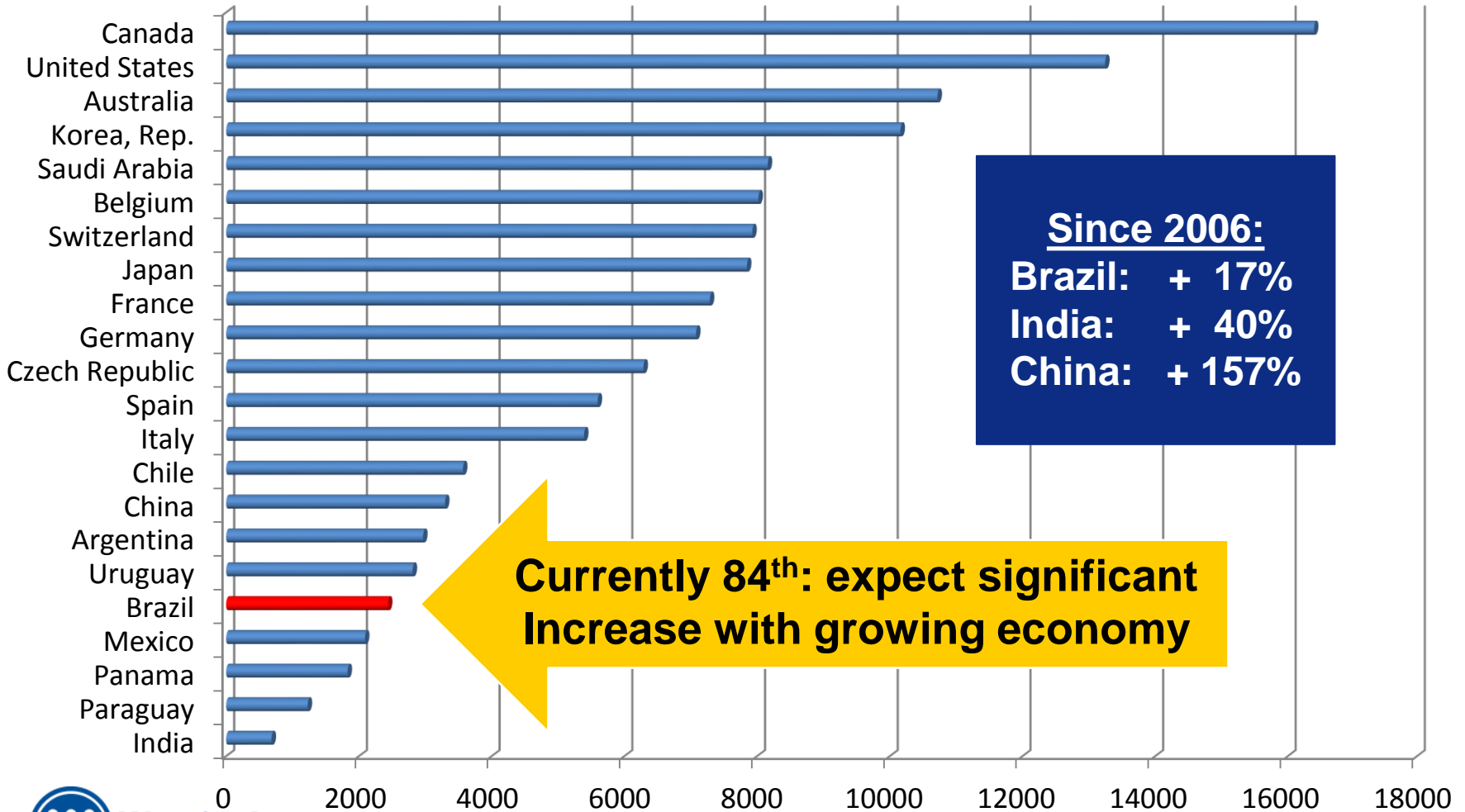


**Top 10 in >100GW Capacity**



**Top 10 in Uranium Reserves**

# Electric Energy Consumption (kWh per Capita)



# Benefits of a Nuclear Project

There are many benefits that come from sustained nuclear projects in a country, including:

- Stable Energy Matrix & Energy Security
- Economic Development
- Technology & Professional Development
- Sustainability and Clean Energy

# Why Develop a Nuclear Project?

**To Drive a Stable Energy Matrix and  
Stronger Energy Security**

## Barragem do Sobradinho chega à menor vazão em 37 anos



Foto: Reprodução / Blog do Carlos Britto

A Barragem do Sobradinho, no Sertão do São Francisco, chegou à menor vazão desde que começou a operar, há 37 anos. **Agora, a capacidade da barragem é de 4%.** A informação é da Companhia Hidrelétrica do São Francisco (Chesf), responsável pela operação do reservatório.

A partir desta terça, a vazão será reduzida para 550 m<sup>3</sup>/s. Conforme os órgãos, a diminuição da vazão é por tempo indeterminado. A iniciativa é para conservar a quantidade de água no lago. Caso não haja chuvas, a previsão é que o reservatório **pode chegar ao volume morto em novembro.**



# Stable Energy Matrix

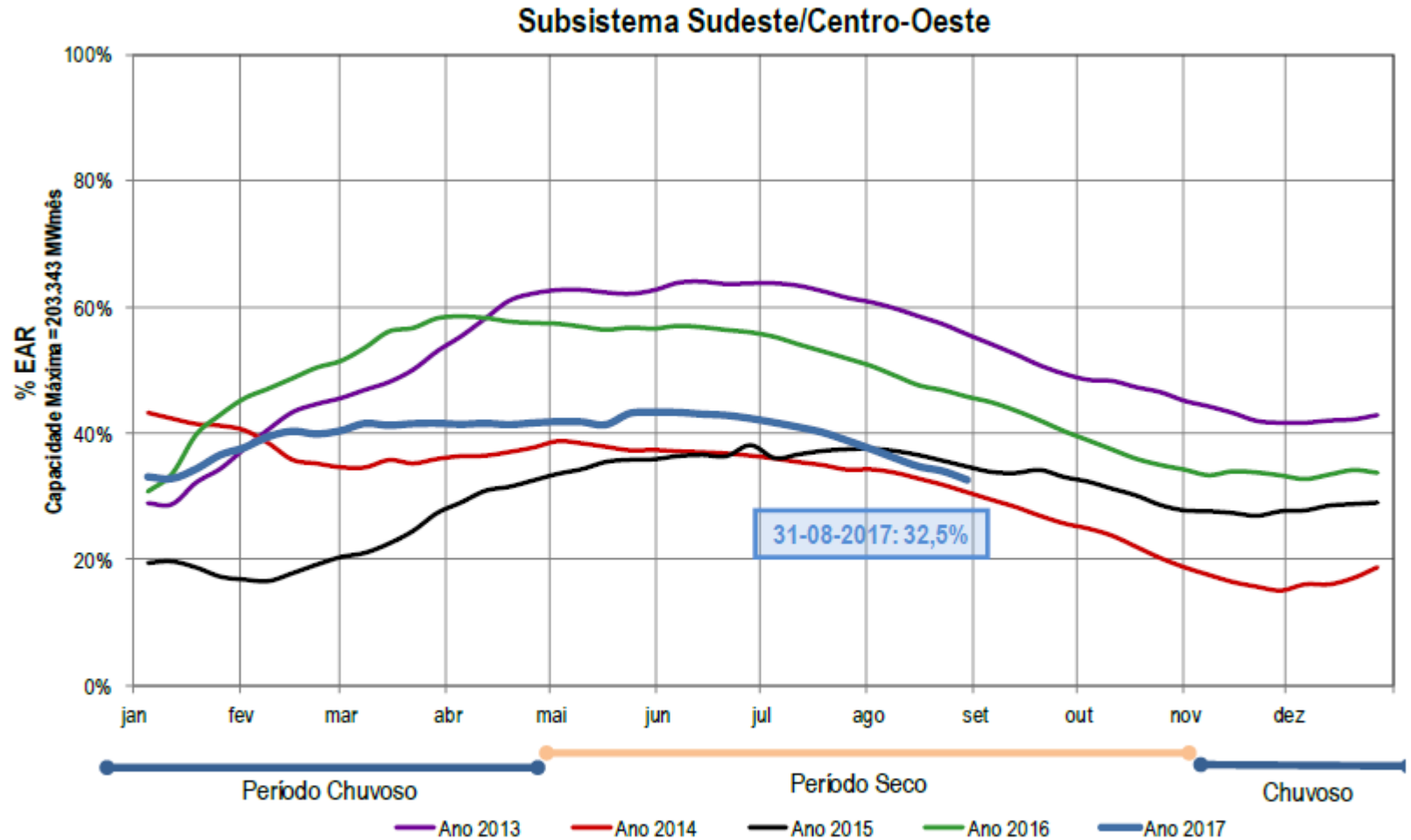


Figura 6. EAR: Subsistema Sudeste/Centro-Oeste.



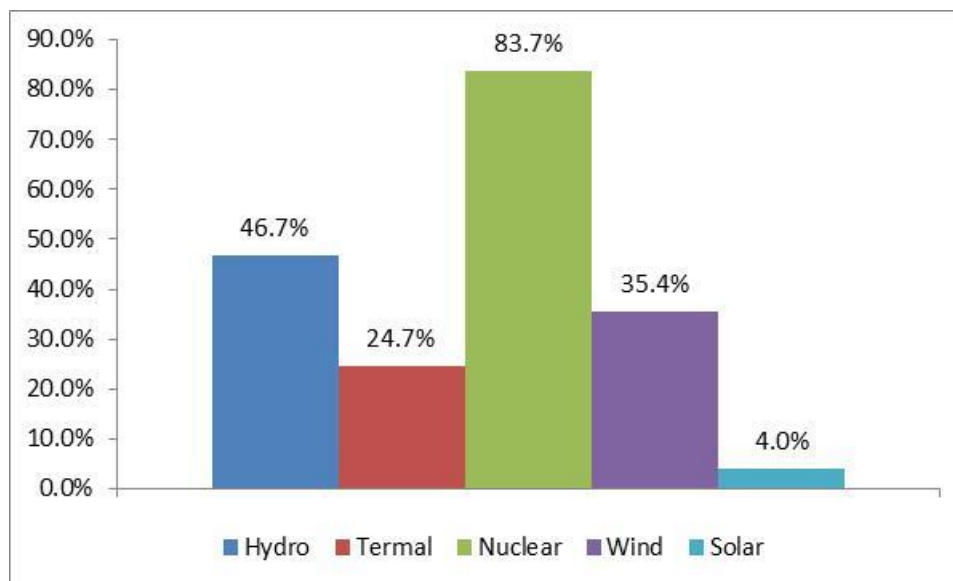
# Stable Energy Matrix

## 4.2. Demandas Máximas

No mês de agosto de 2017 não houve recorde de demanda no SIN e em nenhum dos subsistemas.

Tabela 6. Demandas máximas no mês e recordes por subsistema.

Subsistema	SE/CO	S	NE	N	SIN
<b>Máxima no mês (MW)</b> (dia - hora)	<b>42.972</b> 30/08/2017 - 18h40	<b>13.980</b> 10/08/2017 - 18h41	<b>11.525</b> 31/08/2017 - 14h40	<b>6.605</b> 18/08/2017 - 15h24	<b>73.143</b> 30/08/2017 - 18h50
<b>Recorde (MW)</b> (dia - hora)	<b>51.894</b> 21/01/2015 - 14h32	<b>17.971</b> 06/02/2014 - 14h29	<b>12.692</b> 21/03/2017 - 14h40	<b>6.748</b> 16/05/2017 - 14h41	<b>85.708</b> 05/02/2014 - 15h41



Fonte dos dados: ONS

# Why Develop a Nuclear Project?

**To Drive Economic Development**

# Energy Demand vs. Economic Growth

Tabela 3. Consumo de energia elétrica no Brasil: estratificação por classe.

	Valor Mensal			Acumulado 12 meses		
	Jul/17 GWh	Evolução mensal (Jul/17/Jun/17)	Evolução anual (Jul/17/Jul/16)	Ago/15-Jul/16 (GWh)	Ago/16-Jul/17 (GWh)	Evolução
<b>Residencial</b>	10.389	-3,4%	0,1%	132.306	133.146	0,6%
<b>Industrial</b>	13.953	1,0%	0,1%	164.630	164.528	-0,1%
<b>Comercial</b>	6.653	-4,1%	-0,8%	89.745	87.509	-2,5%
<b>Rural</b>	2.231	0,7%	1,2%	26.352	27.590	4,7%
<b>Demais classes *</b>	3.859	-4,1%	-0,1%	48.935	48.224	-1,5%
<b>Perdas e Diferenças **</b>	8.754	10,3%	-3,4%	112.032	112.556	0,5%
<b>Total</b>	<b>45.838</b>	<b>0,3%</b>	<b>-0,7%</b>	<b>574.000</b>	<b>573.553</b>	<b>-0,1%</b>

\* Em Demais Classes estão consideradas Poder Público, Iluminação Pública, Serviço Público e Consumo próprio das distribuidoras.

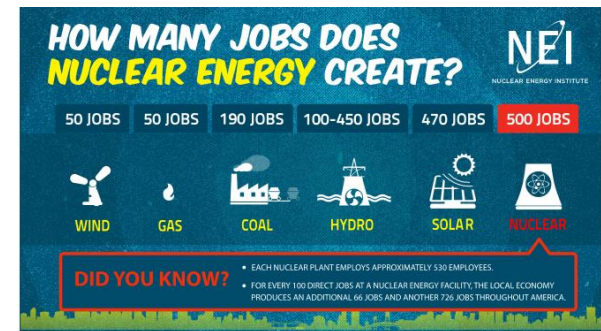
\*\* As informações "Perdas e Diferenças" são obtidas considerando o cálculo do montante de carga verificada no SEB (SIN e Sistemas Isolados), abatido do consumo apurado mensalmente no país (consolidação EPE).

Dados contabilizados até julho de 2017.

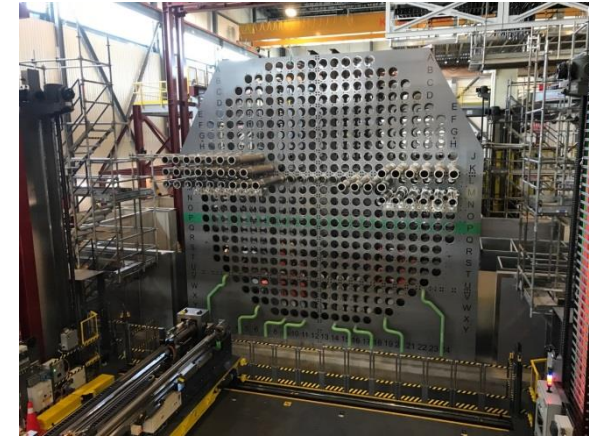
Fonte dos dados: EPE/ONS

# Economic Impact of Nuclear Power in the U.S.

- Sixty two nuclear plants comprising 99 reactors operate in the United States, representing over 100,000 megawatts (MW) of capacity and almost 800 million megawatt hours (MWh) of annual generation,
- Contributes approximately \$60 billion annually to gross domestic product (GDP) (\$103 billion annually in gross output).
- Accounts for about 475,000 full time jobs (direct and secondary).
- Helps keep electricity prices low – without nuclear generation, retail rates would be about 6% higher on average.
- Nuclear power is responsible for nearly \$10 billion annually in additional federal tax revenues, and \$2.2 billion in additional state tax revenues, because of the boost it gives to the economy.



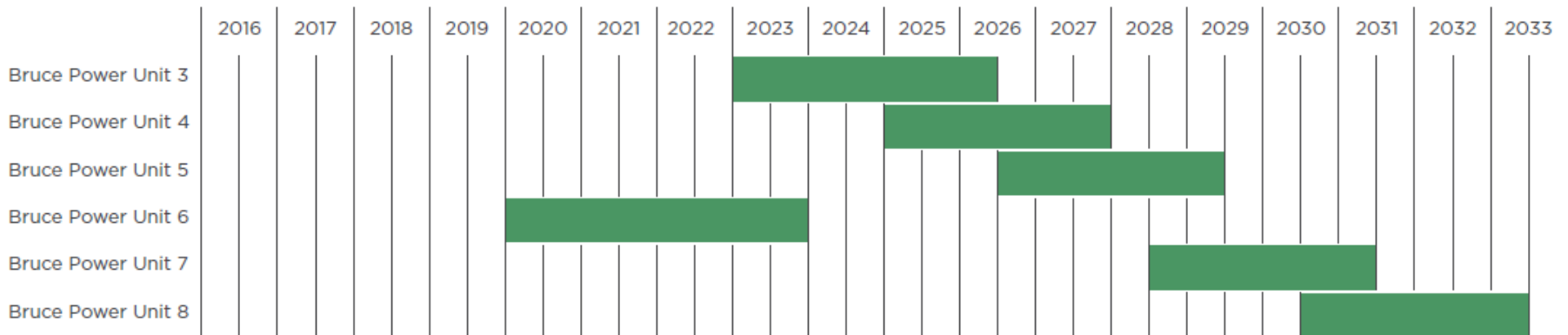
# Canada Nuclear Projects OPG and Bruce Power Refurbishment Plan



## OPG Darlington Refurbishment Project Timeline

**CN\$ 25 Billion Investment  
in 15 years!**

## BRUCE POWER REFURBISHMENT SCHEDULE

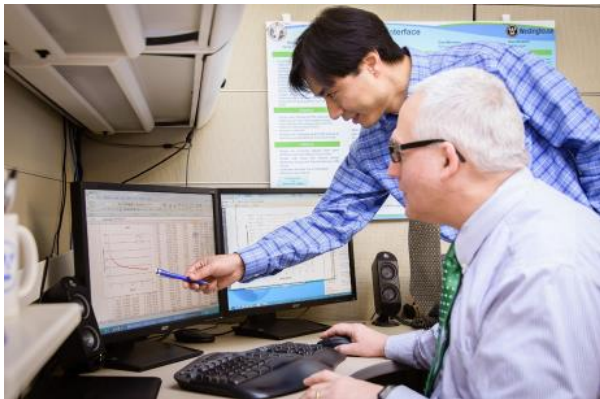


# Why Develop a Nuclear Project?

**To Drive Technology Development**

# Technology Development

- Potential technology transfer to local markets
- Development of new suppliers
  - Security of Supply
- Manufacturing innovation
- Technical and Professional Development





# Risk-Informed Sourcing: Low Risk, A Closer Look

## Low-Risk Commodities / Components:

Are commodities for which localization could be achieved with minimal risk to the project, and likely require minimal investment and time for facility upgrade or manufacture from the local supply base.



LOW RISK

- Non-safety Related Structural Modules
- Non-safety Related Mechanical Modules
- Tanks
- Tools
- Commodities
- Some Cranes
- Construction Material

Typical characteristics include:

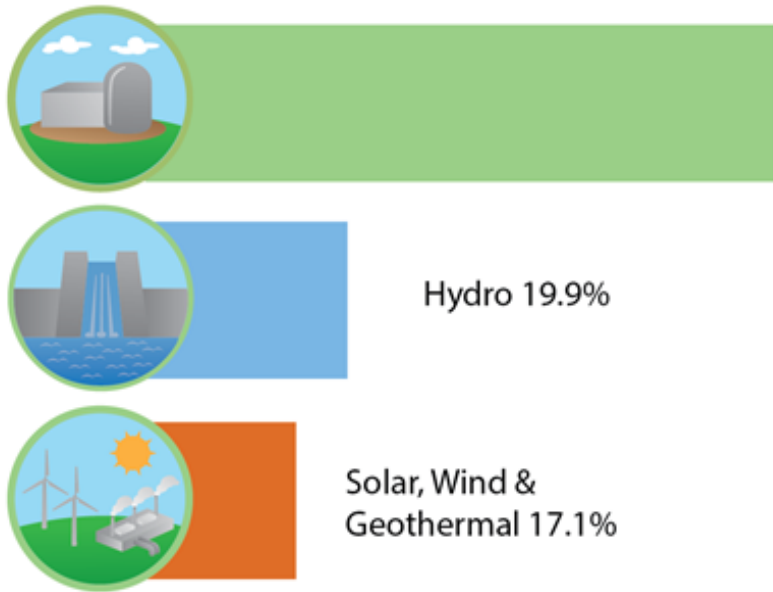
- Low upfront investment by the supplier.
- Non-safety or commercial fabrication requirements.
- Non-safety quality requirements.
- Lower complexity.
- “Build-to-print” specifications.

# Why Develop a Nuclear Project?

**Clean and Reliable Energy**

# Status of Nuclear in the World and US Today

## Sources of Emission-Free Electricity 2014

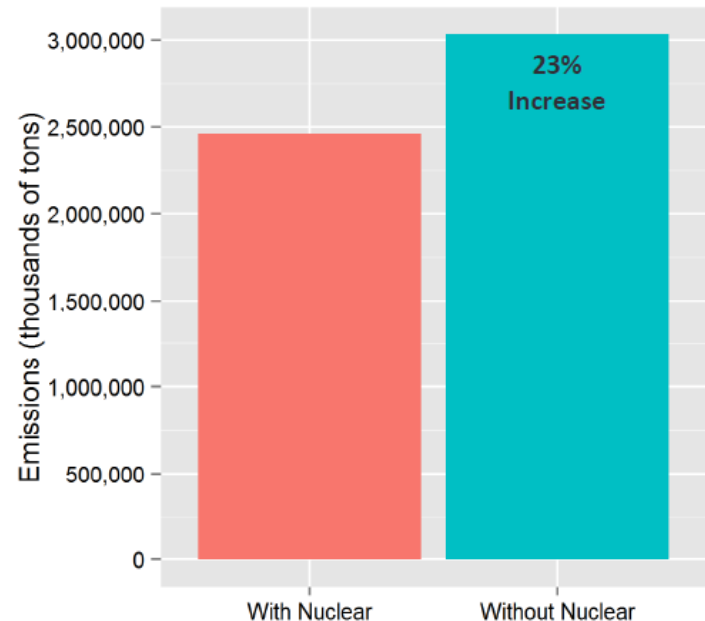


Nuclear 62.9%

Hydro 19.9%

Solar, Wind & Geothermal 17.1%

Figure 4: U.S. Nuclear Industry Prevents Higher CO<sub>2</sub> Emissions (Average Annual, 2015-2024)



# Nuclear Energy and Air Pollution

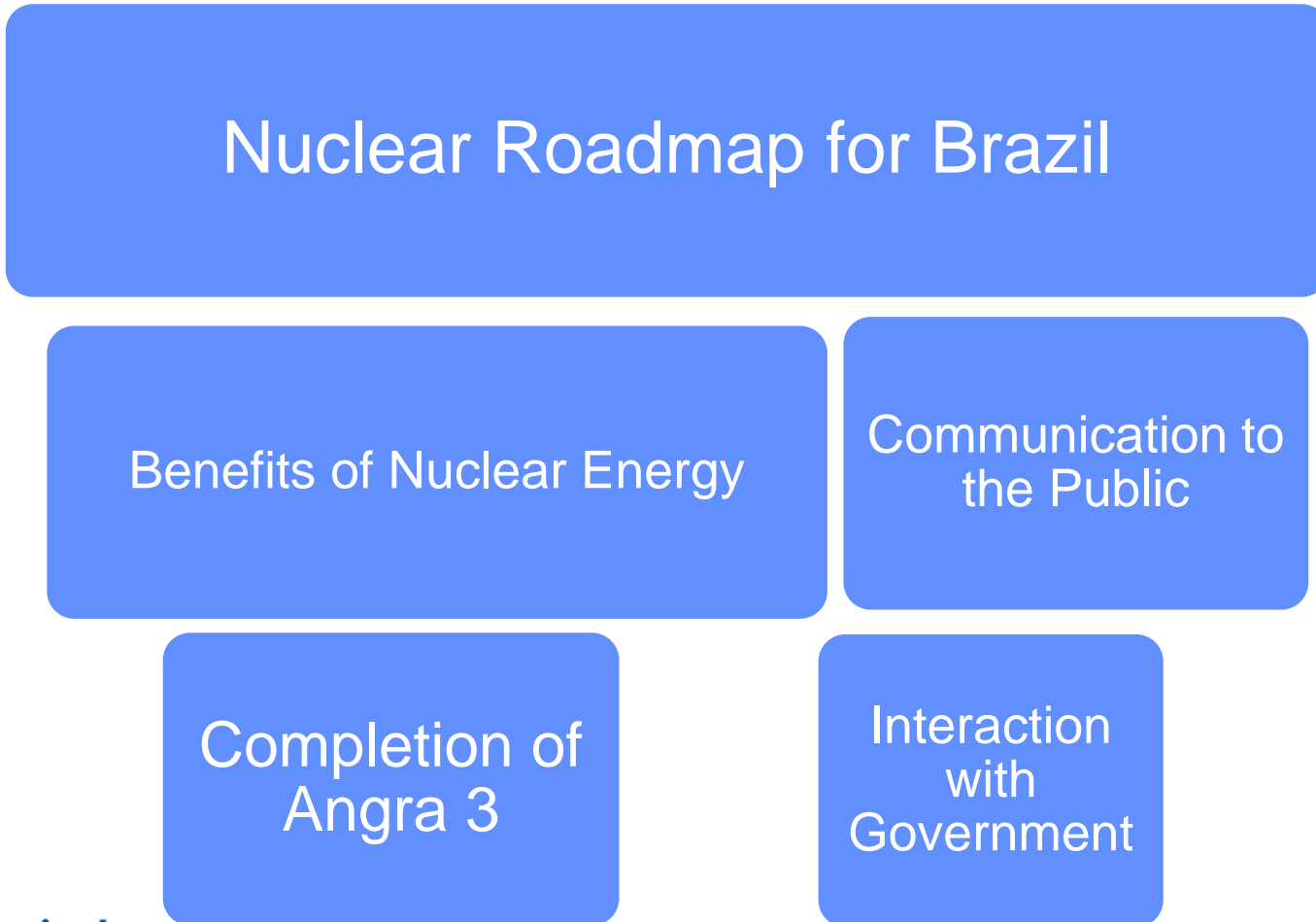
- Nuclear prevents 573 million tons of carbon dioxide emissions, worth another \$25 billion annually if valued at the federal government's social cost of carbon estimate.
- Air pollution causes about 200,000 early deaths each year in the United States
  - Pollution from electricity generation still accounted for 52,000 premature deaths annually
  - every dollar spent on air pollution improvements, we can get between a \$4-\$30 benefit in terms of reduced health impacts

# What are the key challenges?

- Political stability
  - Needed for decisions to be made
- Uncertainties in NPP program
  - Needed to attract private investment
- Human Resources Development
  - Students need clarity of potential jobs
- Communication
  - Sector needs to improve

# Associação Brasileira para Desenvolvimento de Atividades Nucleares (ABDAN)

## 2017/2018 Strategic Plan



# Associação Brasileira para Desenvolvimento de Atividades Nucleares (ABDAN)

## Nuclear Roadmap for Brazil

