



Center for Advanced  
Energy Studies

*A research  
partnership between  
Boise State University,  
Idaho National  
Laboratory, Idaho  
State University and  
University of Idaho.*

# Center for Advanced Energy Studies

## Economic and Employment Impacts of Small Modular Nuclear Reactors

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## ❖ Overview of Small Modular Reactors

*“There is a surge of interest in new, small and medium-size reactor designs that allow a more incremental investment than is required for a big reactor, and provide a better match to grid capacity in many developing countries.” (IAEA)*

## ❖ *Overview of Small Modular Reactors*

### Advantages of Small (<300 MWe) Modular Reactors

- Design features: modularity, simplicity, enhanced safety contribute to lower levelized unit electricity costs (LUEC)
- Smaller scale yields lower capital costs and risk  
MDCs and LDCs
- “Grid-Appropriate” – smaller & localized better match, avoid long transmission lines, grids with limited capacity
- Cogeneration opportunities (industrial steam, heating, desalinization, etc)
- Overcoming ‘energy poverty’ without CHGs

## ❖ *Economic Impacts of SMR Production in US*

Ongoing collaboration between Boise State University, University of Idaho, and Idaho State University

- Estimate market penetration under different adoption scenarios
- Convert projected market into generic 100 MWe units deployed until 2030
- Estimate costs of SMR production
- Estimate economic impacts:

Economic Design/engineering, licensing phase

Building manufacturing facilities

Manufacturing, deployment and operations of SMR units

## ❖ *Economic Impacts of SMR Production in US*

### Estimation of SMR Production Costs

- Develop more precise estimates of overnight costs and LUEC

Based on 3-digit Code of Accounts from EMWG “*Cost Estimating Guidelines for Generation IV Nuclear Energy Systems*”

- Comparison of estimated COAs to other studies and proprietary data for validation

‘Rolled up’ 3-digit COAs to 2-digit COAs

## ❖ SMR Cost Estimation (2-Digit COA)

Account Number	Description	SMR Estimated Cost
21	Structures and improvements	97,148,812
22	Reactor plant equipment	112,863,131
23	Turbine plant equipment	93,647,442
24	Electric plant equipment	34,032,177
25	Miscellaneous plant equipment	19,094,604
26	Heat rejection system	20,497,701
<b>Total Direct Costs</b>		<b>377,283,867</b>
91	Construction Services	94960069.75
92	Engineering and Home Office Services	89028910.2
93	Field Supervision and Field Office Services	46619006.1
<b>Total Indirect Costs</b>		<b>230,607,986</b>
<b>Total Overnight Cost</b>		<b>607,891,853</b>

Estimated SMR Direct and Indirect Overnight Costs: \$608 million

## ❖ *Estimating Economic Impacts*

### Design/Engineering/Licensing

- \$450 million

(DOE: Award for SMR design, engineering, licensing of \$452 million for 2 different design projects, with cost share among 2 awardees)

### First of a Kind (FOAK) unit

- Estimate \$300 million for manufacturing facilities

(Industry estimates, 2011 Univ Chicago study)

### Nth of a Kind (NOAK) units

- Use 3-digit COAs (50+) to map to I-O Model sectors (440+) to better estimate economic impacts of NOAK units

## ❖ *Estimating Economic Impacts*

### Deployment

- Results here based on NOAK deployment schedule using Moderate Nuclear Adoption from CAES study *Economic and Employment Impacts of Small Modular Nuclear Reactors* (2010)
- With international sales omitted 14 units annually by 2030

### Operations

- Revenues cover O&M, re-fueling  
\$0.075/kWh, 95% efficiency, 100 Mwe, 8760 hrs/year



## ❖ *Economic Impacts: R & D Phase*

### Design/Engineering/Licensing Economic Impacts: USA

	Sales	Value-Added	Earnings (Payroll)	Employment	Indirect Business Taxes
<b>Total</b>	<b>\$ 1,294,086,299</b>	<b>\$ 793,751,372</b>	<b>\$ 583,517,685</b>	<b>10,198</b>	<b>\$ 41,809,841</b>

### \$100 Million Research and Design in Idaho: Idaho Impacts

	Sales	Value-Added	Earnings (Payroll)	Employment	Indirect Business Taxes
<b>Total</b>	<b>\$ 169,377,544</b>	<b>\$ 108,295,100</b>	<b>\$ 90,281,321</b>	<b>1,871</b>	<b>\$ 4,211,911</b>

## ❖ *Economic Impacts: FOAK Units*

### FOAK Economic Impacts

	<b>Sales</b>	<b>Value-Added</b>	<b>Earnings (Payroll)</b>	<b>Employment</b>	<b>Indirect Business Taxes</b>
Manufacturing	\$ 2,389,593,291	\$ 1,234,422,550	\$ 762,967,947	13,092	\$ 66,418,424
Construction	\$ 649,313,928	\$ 342,824,605	\$ 228,105,497	4,523	\$19,001,792
<b>Total SMR Production</b>	<b>\$3,038,907,219</b>	<b>\$1,577,247,155</b>	<b>\$ 991,073,444</b>	<b>17,615</b>	<b>\$ 85,420,216</b>
<b>Annual Operations</b>	<b>\$101,566,466</b>	<b>\$76,471,996</b>	<b>\$26,586,992</b>	<b>356</b>	<b>\$ 13,100,859</b>
<b>Total</b>	<b>\$3,140,473,685</b>	<b>\$1,653,719,151</b>	<b>\$1,017,660,436</b>	<b>17,971</b>	<b>\$ 98,521,075</b>

## ❖ *Economic Impacts: NOAK Units*

### N-Kind: Economic Impacts of a Typical SMR Module

	Sales	Value-Added	Earnings (Payroll)	Employment	Indirect Business Taxes
Manufacturing	\$1,419,680,573	\$762,964,837	\$491,813,434	8,490	\$ 40,052,649
Construction	\$649,313,928	\$342,824,605	\$228,105,497	4,523	\$19,001,792
<b>Total SMR Production</b>	<b>\$2,068,994,500</b>	<b>\$1,105,789,441</b>	<b>\$719,918,932</b>	<b>13,013</b>	<b>\$59,054,442</b>
<b>Annual Operations</b>	<b>\$101,566,466</b>	<b>\$76,471,996</b>	<b>\$26,586,992</b>	<b>356</b>	<b>\$13,100,859</b>
<b>Total</b>	<b>\$2,170,560,966</b>	<b>\$1,182,261,437</b>	<b>\$746,505,924</b>	<b>13,369</b>	<b>\$72,155,300</b>

## ❖ *Economic Impacts: Cumulative Impacts*

### Total Cumulative Economic Impacts of N-Kind SMRs 2019-2030

	Sales	Value-Added	Earnings (Payroll)	Job Years	Indirect Business Taxes
<b>Construction/ Manufacturing</b>	\$99,377,640,086	\$ 53,407,538,576	\$34,426,940,402	594,298	\$2,803,685,453
<b>Operations</b>	\$184,405,155,503	\$97,362,187,700	\$64,781,961,214	1,284,550	\$5,396,508,980
<b>Total</b>	\$ 283,782,795,588	\$150,769,726,275	\$99,208,901,617	1,878,848	\$8,200,194,433

## ❖ *Economic Impacts – Summary*

Manufacturing, Construction, Installation and Operation of Each Representative 100 MW SMR Unit:

- Creates over 13,000 jobs; and
- Generates:
  - Over \$2 billion in sales
  - Nearly \$1.2 billion value-added
  - Nearly \$750 million in earnings (payroll) and
  - Over \$72 million in indirect business taxes

## ❖ *Economic Impacts – Summary*

### Cumulative Impacts of Manufacturing, Construction, Installation and Operations of SMRs 2019-2030

- Creates over 1.8 million jobs; and
- Generates:
  - Nearly \$290 billion in sales
  - Over \$150 billion value-added
  - Nearly \$100 billion in earnings (payroll)
  - Over \$8 billion in indirect business taxes

## ❖ *Thank You*

- For Information on Study, Please Contact:

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