

# Contribution of Nuclear Technologies to the Economic Development: The Korean Experience

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- Contribution to GDP from NPP
- Contribution to Regional Income from NPP
- Contribution to GDP from RI





# Linkage Effect of Nuclear Power

- Backward Linkage Effect
  - Stimulating other economic sectors, which provide intermediate inputs for nuclear sector
- Forward Linkage Effect
  - Stimulating other economic sectors, which use the output from nuclear sector





# The Study Focusing on

- Quantifying linkage effects from nuclear sector
  - NPP construction
  - NPP operation
  - From 1980 to 2005 (every 5 years)





# Contribution of NPP construction to national economy

- Applying Input Output Model





# Reorganized 36 sectors in the I-O table

No.	Sector name	Related nuclear activity
1	Agriculture, forestry, and fisheries	Food processing
2	Mining and Quarrying	
3	Food, beverage and tobacco	Food processing
4	Textile products & leather products	
5	Wood and paper products	
6	Printing, publishing and reproduction of recorded media	
7	Petroleum and coal products	
8	Chemicals and allied products	Radiochemistry
9	Inorganic basic chemical products	Nuclear fuel fabrication
10	Nonmetallic mineral products	Non-destructive testing
11	Primary metal products	Non-destructive testing
12	Fabricated metal products	Non-destructive testing
13	General machinery and equipment	Manufacturing of main components and other machinery
14	Electronic and other electric equipment	Manufacturing of instrument and control devices
15	Precision instruments	Non-destructive testing
16	Transportation equipment	
17	Furniture and other manufacturing products	
18	Water power generation	
19	Thermal power generation	External electricity supplied to nuclear power plant in operation
20	Atomic power generation	Nuclear power plant operation
21	Self-power generation	
22	Gas and water supply	
23	Repair construction	Construction related to the operation and maintenance
24	Electric power plant construction	Construction of new nuclear power plant
25	Wholesale and retail trade	
26	Eating and drinking places, and hotels and other lodging places	
27	Transportation and warehousing	
28	Communications and broadcasting	
29	Finance and insurance	Finance and insurance of nuclear power plant
30	Real estate agencies and rental	Siting
31	Business services	Architecture engineering
32	Public administration and defense	
33	Educational and research services	Research reactors
34	Medical and health services, and social welfare	Nuclear medicine
35	Social and other services	
36	Dummy sectors	



# Formulation of analysis

$$X = (I - A)^{-1} Y$$

X : Induced output

Y : Final demand vector for NPP building

# Matching NPP construction data to sectors in IO

## Collected cost items

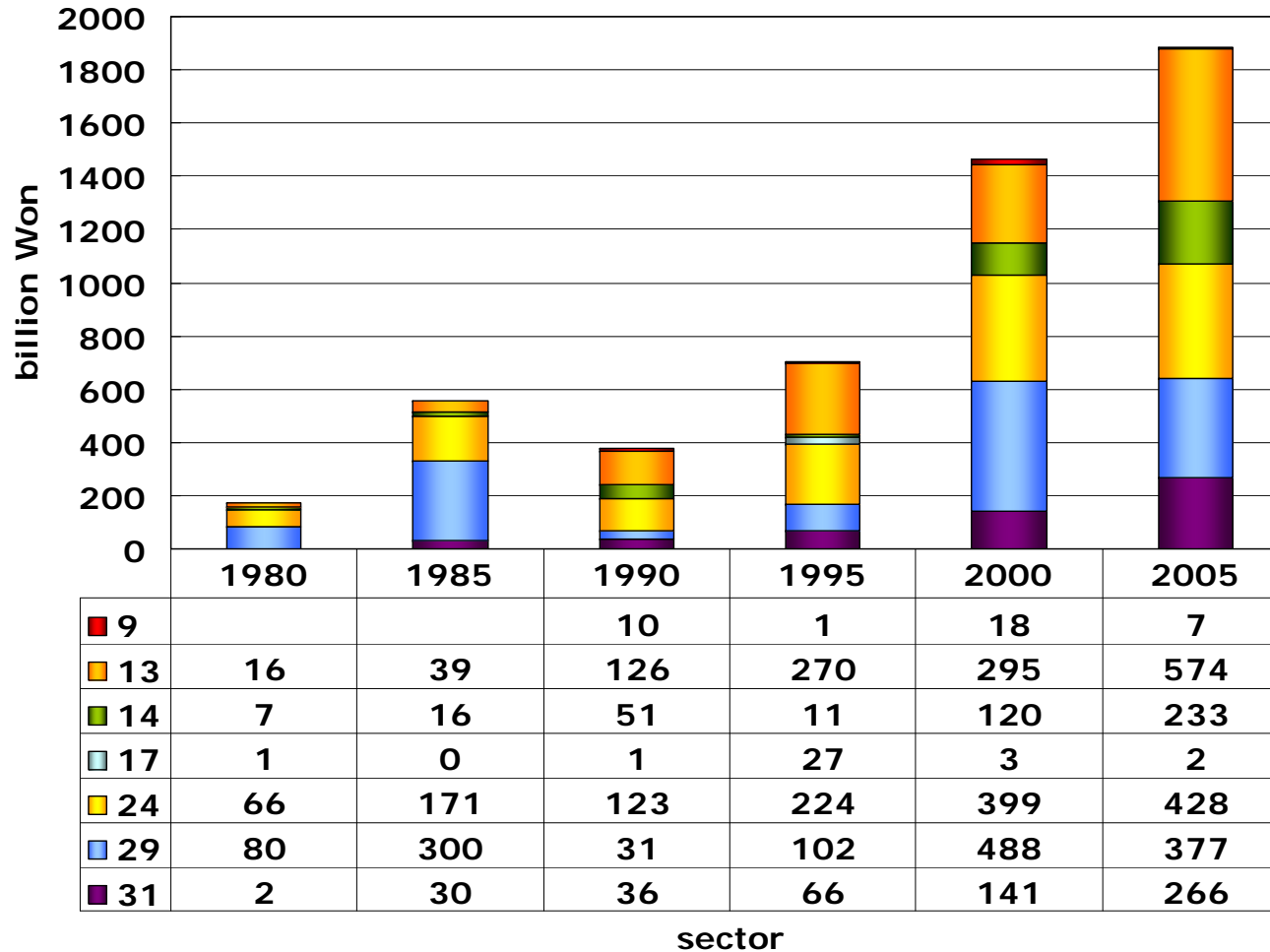
- ✓ Initial fuel
- ✓ Building, structures
- ✓ Machinery equipment
- ✓ A/E
- ✓ IDC
- ✓ Owner's cost

## Sectors in IO

- ✓ Inorganic basic chemical products(9)
- ✓ Electric power plant construction(24)
- ✓ Electronic & other electric equipment (14), General machinery equip.(13)
- ✓ Business services(31)
- ✓ Finance and insurance(29)
- ✓ Business services(31), furniture & other manufact.(17), finance & insurance(29)



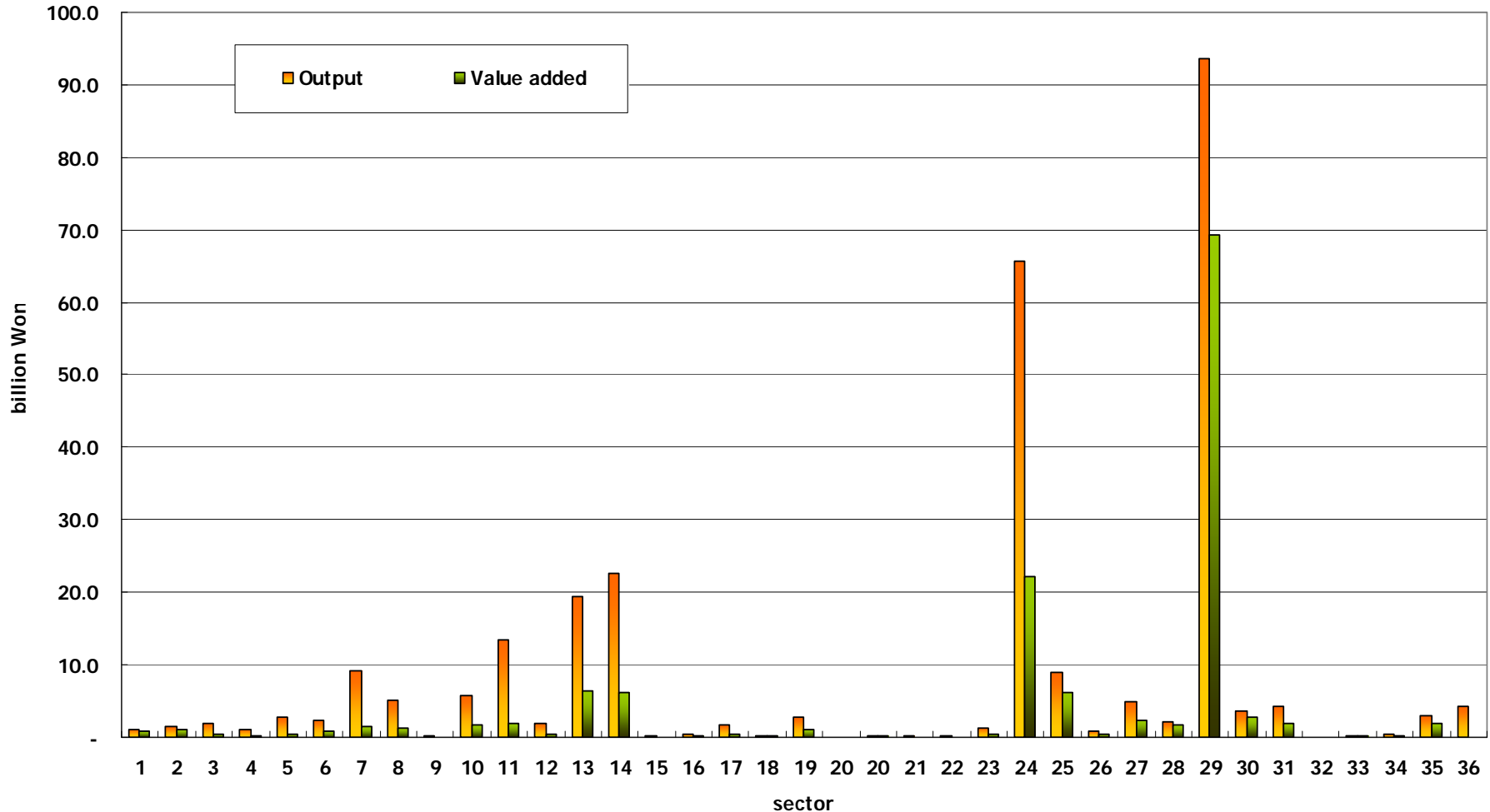
# Creation of final demand vector for NPP construction by year with industry





# Contribution by NPP construction

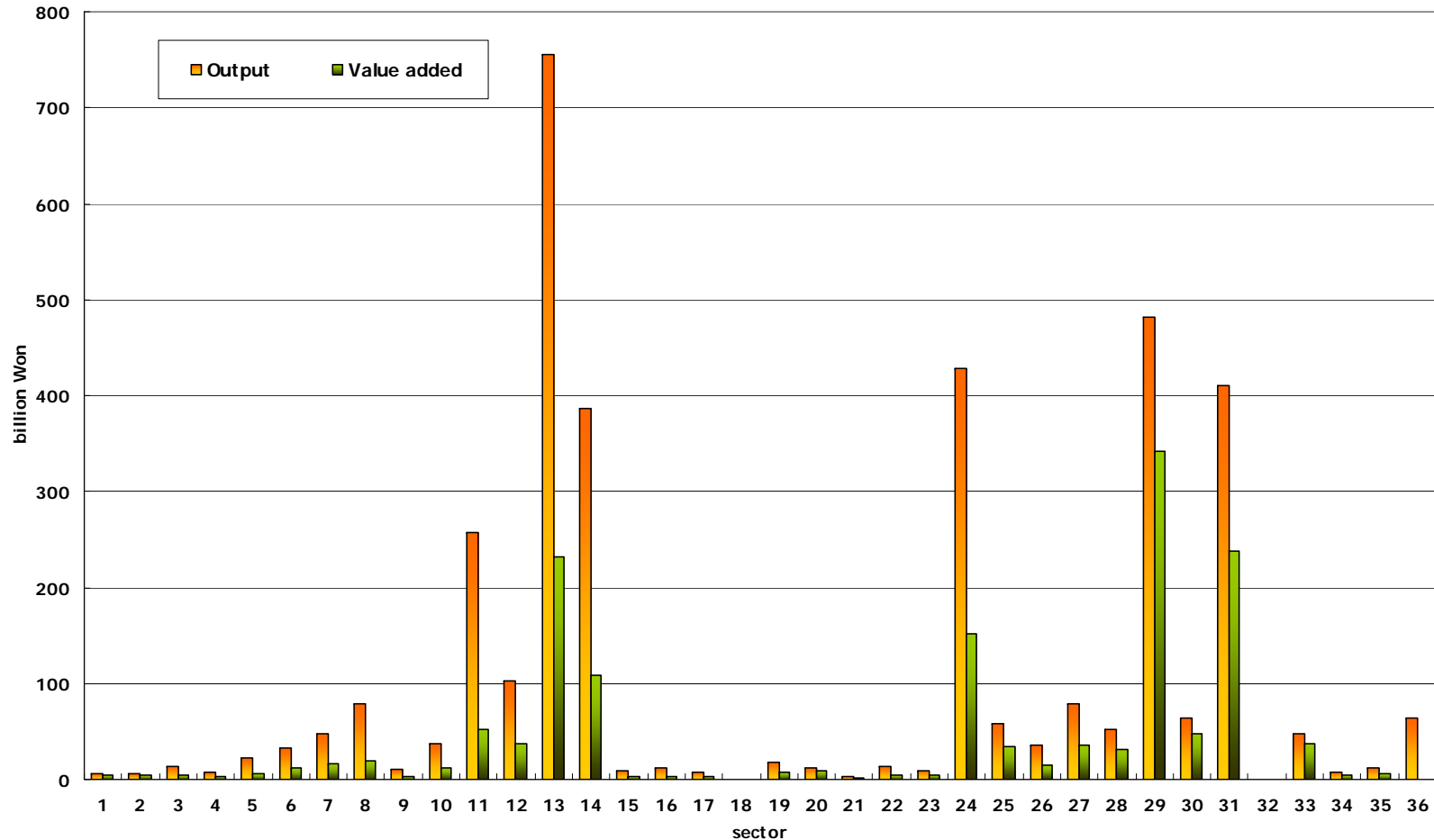
- Output & Value Added (36 sector, 1980) -





# Contribution by NPP construction

- Output & Value Added (36 sector, 2005) -





# Contribution of NPP operation to national economy

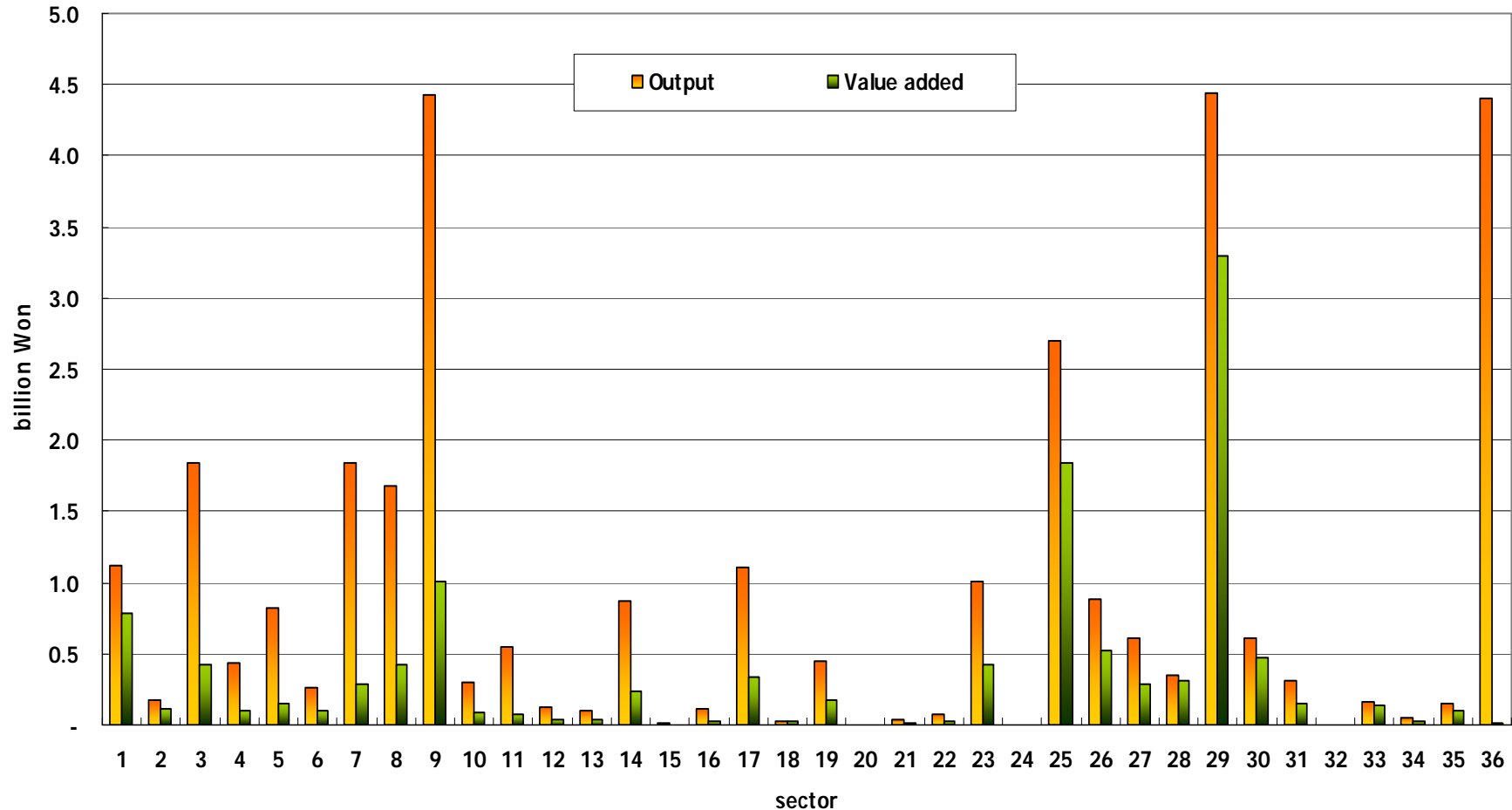
- Applying the same formula as in the construction





# Contribution by NPP operation

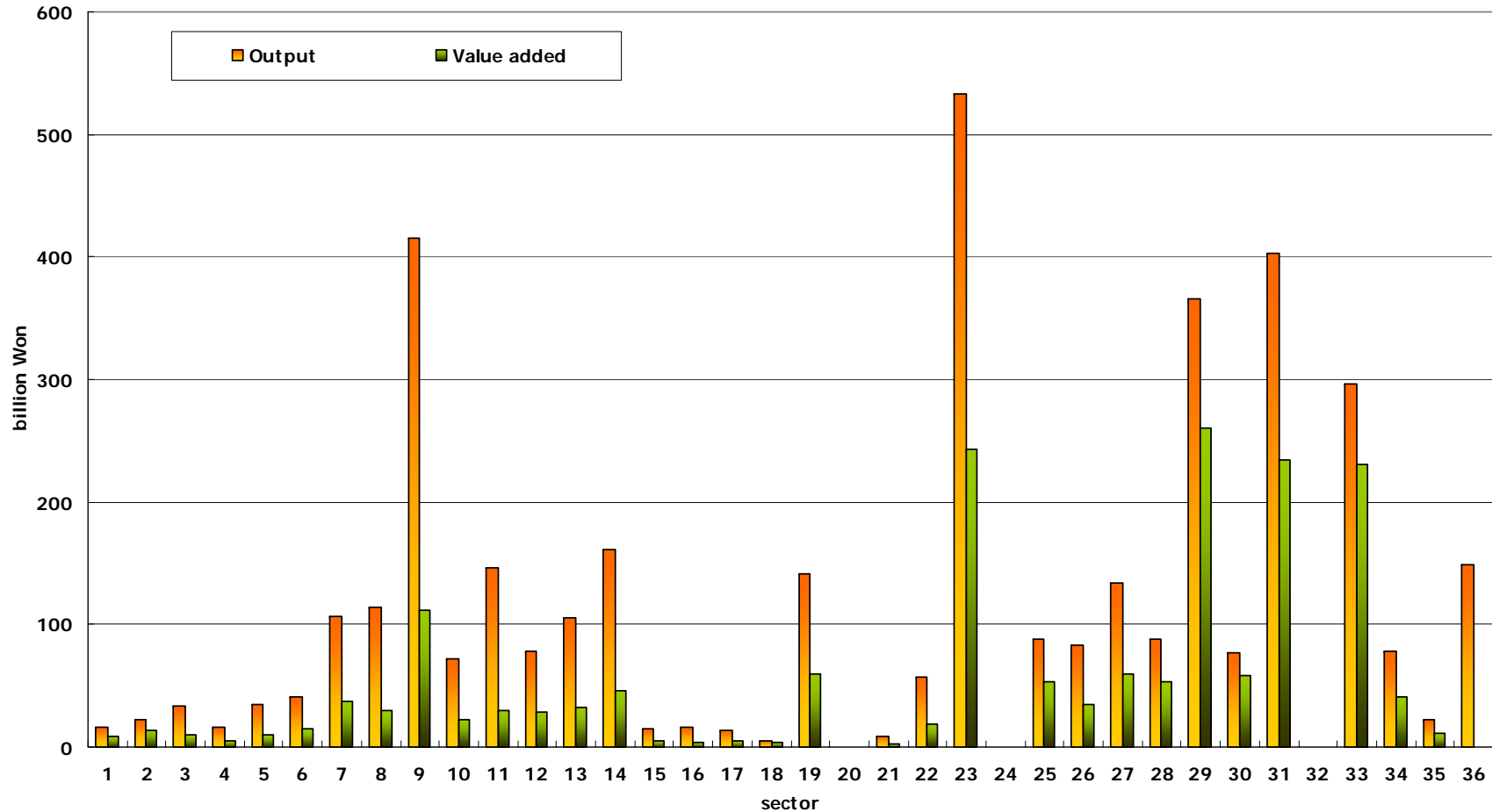
- Output & Value Added (36 sector, 1980) -





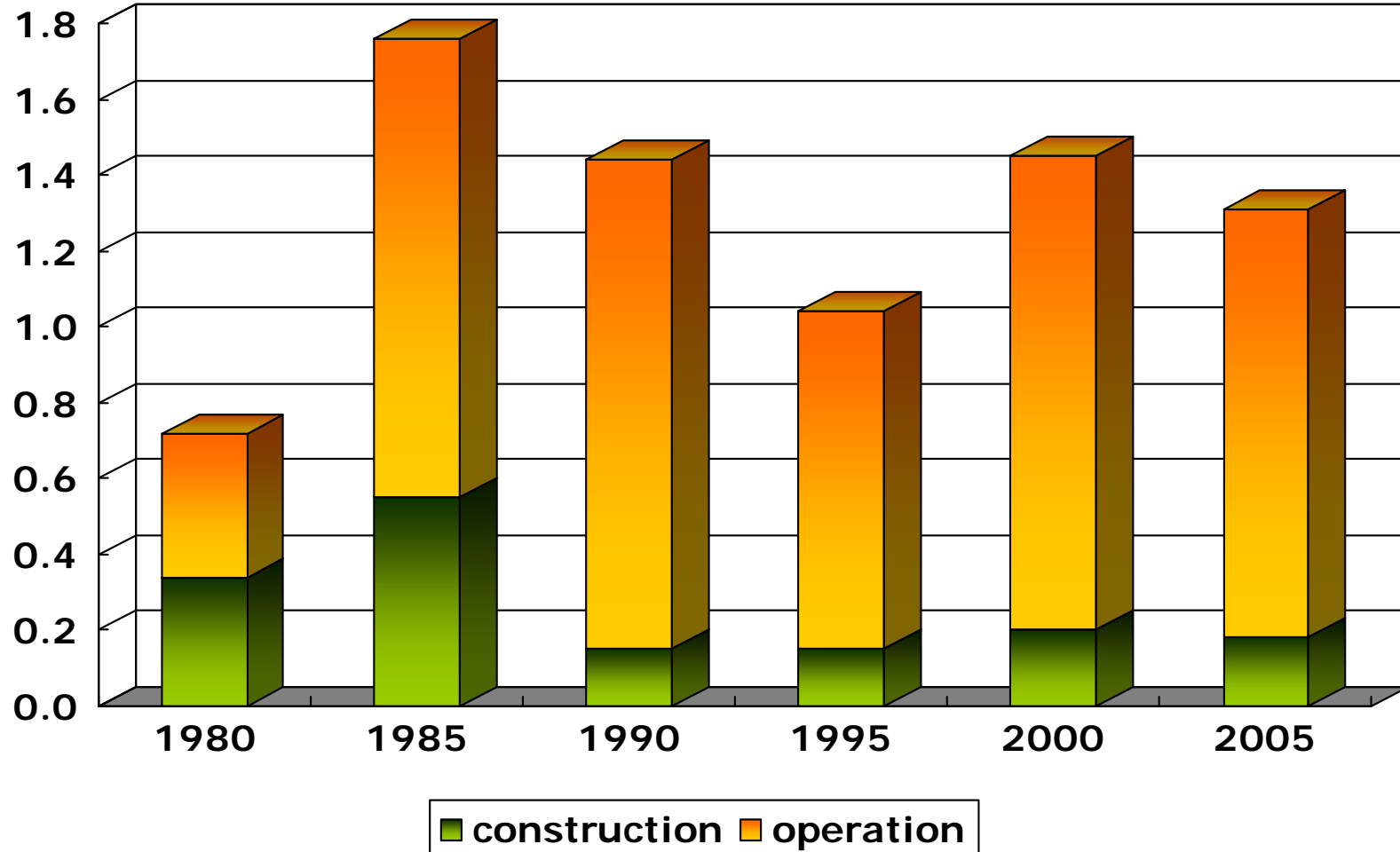
# Contribution by NPP operation

- Output & Value Added (36 sector, 2005) -





# Summary of the contribution of nuclear power sector to GDP





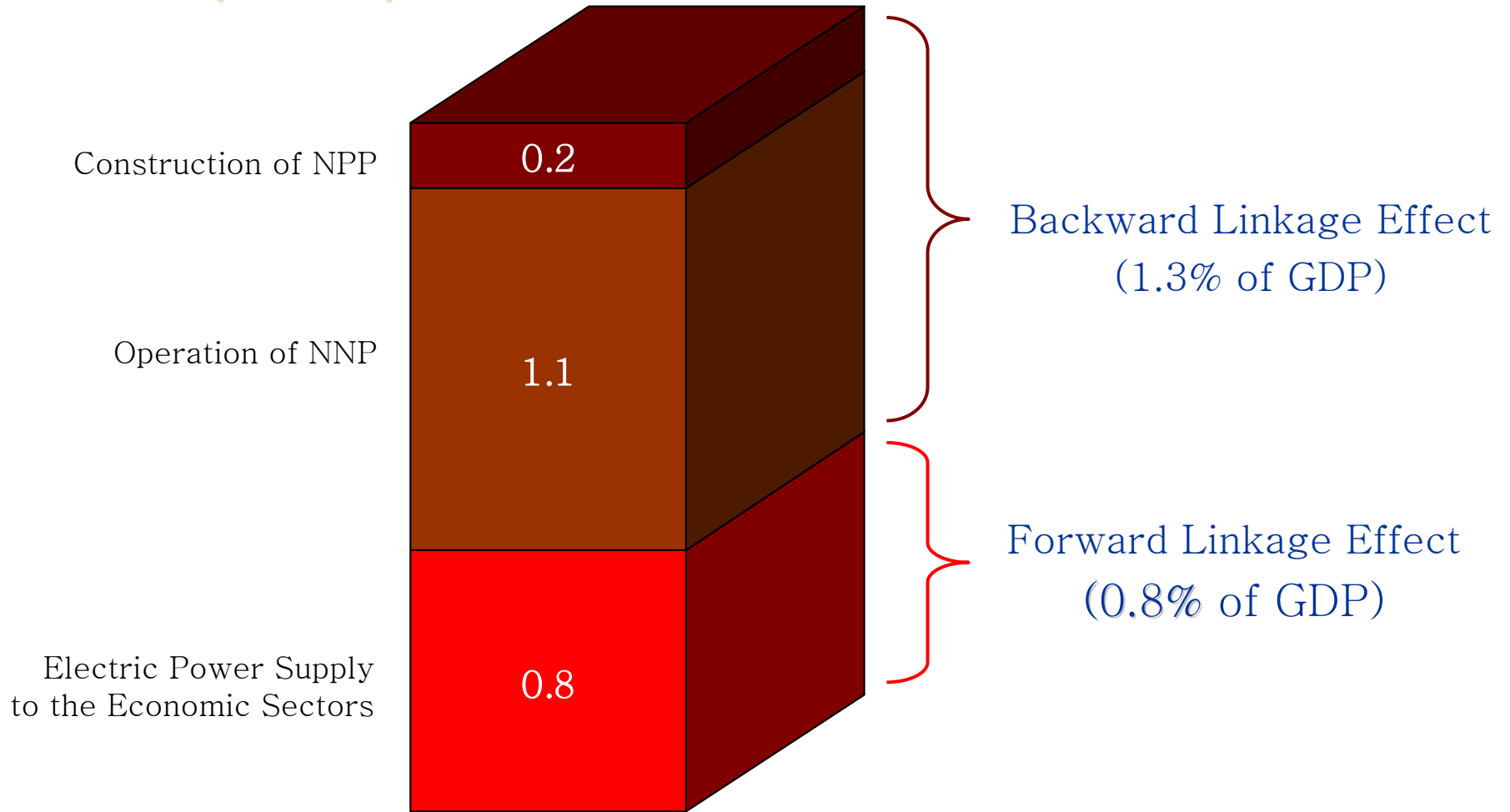
# Forward Linkage Effect

- Electric Power Supply to the Economic Sectors
  - 0.77% of GDP
    - = Revenue of Nuclear Power × Supply Induced Multiplier





# Total contribution of nuclear power sector to GDP(2005)



Total Effect : 2.1% of GDP



# Percentage Shares of 4 Major Industries to GDP in Korea

In the year of 2005

<b>Primary iron and steel products</b>	<b>Semi-conductor</b>	<b>Automobile</b>	<b>Petroleum refinery Products</b>
<b>1.6%</b>	<b>1.5%</b>	<b>2.5%</b>	<b>2.7%</b>



# Nuclear Power's Incremental Contribution to the Economic Development

- Replacement of all the nuclear power by fossil fuel generation
  - Backward linkage effect
  - Stabilization Effect on Electricity Price from Nuclear Power



# Incremental Nuclear Contribution to GDP

- from Backward Linkage Effect
  - 0.3~0.8% of GDP depending on the periods
    - In 2005, it is 0.3~0.4%
- from Stabilization of Electricity Price
  - 0.27% of GDP for the average past 5 years
    - = Increasing rate of electricity price without nuclear power (7.5%) × Electricity Price Elasticity of GDP(0.036)
- In total(2005), 0.6~0.7% of GDP



# Contribution to Regional Income from NPP

- Empirical Study on Ulchin site of NPP
  - By using Regional Input Output Model





# Socio-economic aspects of Ulchin

- Location
  - The East Coast
- Population
  - 57,000 person in 2005
- GRDP
  - 1.8(Billion Dollar) in 2005
  - Only 0.21% out of GDP in 2005
- Nuclear Power Plant
  - 6 units
  - 12.5% of total power generation in 2005





# Economic activities related with nuclear power in the region

- Construction of NPP
- Operation of NPP
- Local Taxes paid by NPP
- Special support for infrastructure and regional development projects
  - Subsidized electricity
  - Social welfare projects
  - Industrial relocation assistance
  - Education



# Total Regional Income Effects of Ulchin Nuclear Power Plant (In Billions Won)

	Nuclear Power		Npp Areas Regional Project	Local Taxes	Total	Shares to Total Regional Income
	Construction	Operation				
<b>1990</b>	0	20.0	0.6	-	20.5	-
<b>1995</b>	65.1	23.1	1.4	2.4	92.1	39%
<b>2000</b>	67.2	44.8	3.5	6.4	121.9	43%
<b>2001</b>	65.7	55.3	5.0	2.4	128.4	43%
<b>2002</b>	74.5	50.9	4.2	3.9	133.6	40%
<b>2003</b>	68.7	81.4	6.0	4.8	160.9	44%
<b>2004</b>	36.1	74.0	4.3	5.2	119.6	26%
<b>2005</b>	0	75.5	3.2	10.9	89.7	20%





# Contribution to GDP from RI

- Applying IO analysis
  - Maintaining the same sectoral classification as nuclear power
- Economic contribution from RI is based on RI utilization
- This study focuses on those selected sectors
  - Manufacturing, Medical, R&D





# Summary of value added to GDP from selected radioisotope related industries (In Billions of won)

		1980	1985	1990	1995	2000	2005
<b>Output</b>	Manufacturing	391	1,054	2,009	4,214	7,547	10,787
	Medical	49	207	408	970	2,398	4,040
	R&D	-	-	-	-	-	-
	<b>Sub total</b>	<b>440</b>	<b>1,261</b>	<b>2,417</b>	<b>5,184</b>	<b>9,945</b>	<b>14,827</b>
<b>Value added</b>	Manufacturing	88	277	592	1,437	2,360	3,488
	Medical	22	102	196	504	1,101	1,904
	R&D	-	15	15	15	15	15
	<b>Sub total</b>	<b>110</b>	<b>394</b>	<b>803</b>	<b>1,956</b>	<b>3,476</b>	<b>5,407</b>
<b>GDP</b>		38,775	84,061	186,691	398,838	578,665	810,516
<b>Value-Added Contribution to GDP</b>		<b>0.28%</b>	<b>0.47%</b>	<b>0.43%</b>	<b>0.49%</b>	<b>0.60%</b>	<b>0.67%</b>

# Thank You!

