

Upstate New York

Assessing the Economic Impact of Attracting Semiconductor Industry

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EXECUTIVE SUMMARY

Prepared by Semico Research Corp.

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Executive Overview

Since its inception, the semiconductor industry has been an attractive industry to state and local governments around the world. The example of the growth of the economy in Silicon Valley in California, Austin, Texas and the Hillsboro region of Oregon are enviable economic models. Not only do the semiconductor manufacturers themselves generate tremendous revenue, but associated spin-off companies and support structure spawn growth.

The employees of semiconductor fabs hold advanced degrees and possess skills necessary to grow the technology field. Semiconductor employers and support industries seek employees with specific scientific skills. Education is a priority for semiconductor companies and its employees. This fact focuses time and money on the educational system and results in more science and math emphasis.

The “clean industry” is how the semiconductor fabs are perceived. Emissions are controlled and water is reclaimed so both do not impact the environment negatively. The clean environment lifestyle is an attraction to the educated, skilled workers sought by the semiconductor fabs.

Semiconductor companies work hard to be good neighbors. Every community with a semiconductor company benefits from semiconductor company volunteers to local programs and from donations of equipment and resources to colleges and universities. The growth of amenities in the community is a plus for all the residents. The availability of cultural programs from orchestra to interesting speakers adds value to the community.

New York State has an enviable existing environment with the Albany NanoCollege, International Sematech, IBM and other semiconductor-related industries already in place. Very few new 300mm fabs are built every year. The cost is onerous and semiconductor companies face lower margins every year. Only through a partnership with the state can a semiconductor company afford to locate to an area in the US.

As discussed in the full report, many geographic areas are willing to work with a company to attract it to an area. The site, the financial capacity, the educational facilities, the environment, and the team to accomplish the task of finalizing the building of a new 300mm fab all can work for upstate New York and the return on investment to New York State is significant – in excess of 200 percent over a five year period. This summary focuses strictly on that economic analysis.

Economics: Upstate New York (Example County – Oneida)

New York State has an active program to attract new technology to the region. The semiconductor industry outreach and attraction efforts offer a unique opportunity to prospective companies.

Residential Market

- Mohawk Valley represents 0.1% of the nation's households
- Cost of living 9% below national average
- Median income is 97% of the national average, while the median home cost is 62% of the average
- Average 2 bedroom apartment rent is 86% of the national average
- Water quality is one of the highest in the nation ranking 60% above the national average based on EPE water quality index
- K-12 Pupil/Teacher Ratio is 91% of the national average
- 5 higher education schools, two 4-year and three 2-year institutions

Business

- Downtown and suburban lease rates are 69% of the national average
- Industrial lease rates and 67% on the national average
- Construction cost for industrial space is 98% of the national average
- Construction cost of office space is 93% of the national average

The upstate New York counties involved in this project do not have a developed electronics/semiconductor base; however, during the past 10 years the State of New York has established a significant foothold in nanoelectronics with the 300-acre Marcy NanoCenter at the State University of New York Institute of Technology. The state-wide marketing program, NY ♥Nanotech, has given New York world recognition as premier center for the development of innovative technology.

Upstate New York can capitalize on the success of New York's nanoelectronics program and the synergy with the semiconductor industry with the building of a 300mm wafer fab.

Overview of the Economic Impact

A semiconductor manufacturing fab will have a financial impact on the state from the planning start date of construction. Following is a high level list of impact of the fab itself. The impact of the construction is covered under construction issues.

Impact on New York State and Local Areas

Following is a list of some of the positive aspects of the location of a semiconductor fab to Upstate New York. Additional jobs at higher wage rates are the immediate benefit.

- Employment of entry level personnel
 - Skill set required
 - One year's experience
- Salaries
 - Wafer operators (starting salaries) \$40,000
- Skill set salaries for fab workers
 - Engineers 80% or 352 moving to area
 - Management 70% or 69 moving to area
 - Support Staff 40% or 26 moving to area
 - Fab operators 30% or 148 moving to area
- Salaries
 - Engineers average salary \$75,000
 - Management average salary \$110,000

The construction of a manufacturing plant will bring construction laborers to the area along with families for the one to three years required to build. Because additional construction of new homes and businesses will be required for the increased population, a large percentage of the construction people will stay in the area. Additional employment of people moving/migrating to the area will also include support for the fab.

A wide variety of support jobs for the fab would also be created; not limited just to those listed.

- Fab garment cleaning
- Computer sales maintenance
- Warehousing
- Delivery service
- Chemical disposal
- Satellite equipment offices
- Specialty products
- Maintenance
- Training
- Private security

Additional jobs revolving around the fab are the suppliers of equipment, materials and services. Included in this number are jobs for spouses and work age children.

Table 1. Additional Jobs Created by Fab

Direct Jobs	435
Direct earnings	\$17.4 million
Multiplier Effect Jobs	634
Multiplier Earnings	\$25.4 million

Source: Semico Research Corp.

With increased population come increases in the services area. Doctors, teachers, lawyers, accountants, sanitation workers, etc are added to the required job support base. Real estate demand is projected to increase about 15% in two to three years.

This all equates to an increase in the tax base (property, sales, income, etc.). Direct state generated revenue and additional business per year is represented below.

Table 2. Additional State Generated Revenue

Income Taxes	\$14.4 million
State Sales taxes	\$19.2 million
County Sales taxes	\$20.3 million
Added business to economy	\$370.1 million

Source: Semico Research Corp.

Table 3. Additional Jobs Created in the Community

Additional Jobs	2,419
Additional Earnings	\$98 million
State Sales Tax	\$2.1 million
County Sales Tax	\$2.2 million
Additional State Income Tax	\$6.7 million

Source: Semico Research Corp.

New jobs and growth would stimulate local area schools and healthcare expansion. Assuming 1.5 children per household, 894 new children would need to attend local schools.

Workforce education and retraining programs would be needed to provide a long-term supply of skilled workers for the manufacturing jobs. In order to only recruit 30 to 60 percent of employment from out-of-area there will need to be workforce education and retraining. This will come from local schools and local company programs. Some counties in Oregon specialize in cooperative retraining programs to keep jobs in Oregon.

Synergies with educational institutions and universities (R&D) such as SUNYIT and MVCC need to be coordinated to achieve increased employment levels.

Private company and small business investment will enjoy a gradual incremental increase. This ranges from the expansion of chains to new shopping centers. Other investment, of course, would come from support business and supply chain listed previously.

Expansion of infrastructure such as transportation (highways, airport, etc.), utilities (water, sewer, electric, gas, telecommunications, etc.), public services (police, fire, etc.), education (schools, universities), R&D centers – are all part of the expansion of employment and revenue generation for the area. However, given the robust infrastructure of Upstate New York, required expansions may be limited. Some of this expansion will be accomplished with companies and organization present in other locations in New York.

The following is the ROI for the State of New York on the investment to attract a semiconductor manufacturing plant.

The state investment is estimated at \$650 million. This would equate to the total cost of the incentive package offered by the State to the company building the fab.

Benefits to the State are defined as the following:

- Additional State taxes
- Additional County taxes
- Jobs from the attracted manufacturing company
- Jobs to support the manufacturing process
- Jobs to support workers of the manufacturing company and the support businesses
- Added value to the community in the form of:
 - Stronger real estate market
 - More economic opportunities for the citizens

Significant manufacturing operations tend to stimulate the cultural aspects of a community like:

Performing arts
Museums
Charities

Summary of Economic Benefits

Jobs head the list driving economic benefits to the state. Building and operating a semiconductor manufacturing facility was examined in two phases. The construction phase impact comes first.

Phase 1 Construction

The number of jobs for construction is based on statistics from other 300mm fab construction projects.

Table 14. Additional Jobs Created in the Community

Job Definition	Number Employed
Construction jobs (1.4 years)	1500
Additional jobs for the multiplier affect	2550 (1.7 employment multiplier used)

Source: Semico Research Corp.

The fab construction will add jobs up to two years before the manufacturing fab is opened. These are commercial firms with first-class operations. Union workers will be employed and salaries will be at scale or above for the region. These are construction firms that comply with all federal and state regulations. Construction workers are experienced and qualified for their jobs. Salaries are commensurate with the level of expertise. In many cases, upon completion of construction of the first fab, construction begins on a second.

Building - Brick and Mortar Trades = \$300 million, 1-2 years (The shell plus wages)

Masons

Electricians

Plumbers

Communication technicians

Following the completion of the fab shell, the addition of equipment is the next step. This is a lengthy process that leads to the full production capabilities of the manufacturing facility. The following lists the number of people estimated to accomplish this step.

Facilitizing with semiconductor fab equipment = \$3 billion, 1-2 years

Company technicians = 100

Company Process engineers = 75

Company facility engineers = 25

Support company technicians = 50

Employments During Construction

Brick and Mortar

1500 trades workers for 1.4 years

\$135 million in W2 earnings

Multiplier affect from construction spending is \$353 million

State income tax from labor W2 = \$16.3 million

State sales taxes = \$7.5 million

County sales taxes = \$8.0 million

Incremental state and local sales and income tax is \$31.9 million

One typical semiconductor fabrication plant uses

- Greater than or equal to the amount of power as 7500 houses
- Nearly 1 billion gallons of water per year

Phase II Fab Job Generation

The construction job phase generates employment for workers who may leave the area at the completion of the fab, unless construction begins on a second fab. Other construction jobs will be created in the area to build new houses and businesses. The jobs generated by the fab itself will be long-term and permanent jobs. The following table presents the number of jobs for a full production fab.

Table 5. Manufacturing Jobs

On Site Jobs	Number of Jobs
Wafer Fab Operators	495
Engineers	440
Management	99
Support Staff	66
Outside Vendors on-site	60
Total on-site Jobs	1160
Jobs Multiplier from Fab	894
Total Jobs	2054

Source: Semico Research Corp.

There is also an outside support industry mentioned previously, including, but not limited to: fab garment cleaning, computer sales/maintenance, warehousing, delivery service, chemical disposal, satellite equipment office, specialty products, training, private security.

Table 6. Support Industry Jobs

Offsite Jobs	Number of Jobs
Support industry jobs	435
Multiplier for offsite jobs	634
Total Jobs	1069

Source: Semico Research Corp.

Looking at the numbers, it becomes obvious that the impact of a manufacturing fab will have a very positive effect on the employment of the Upstate New York region as well as for the state as a whole. The following table shows jobs by project phase.

Table 7. Jobs by Project Phase

	Base Jobs	Potential Upside Jobs
Total Jobs Phase I	1500	2550
Total Jobs Phase II	4014	634
Total Jobs	5514	3184

Source: Semico Research Corp.

Potential upside jobs are dependent upon a number of unpredictable variable situations. Construction can be expedited and that adds more jobs. Condition of the infrastructure and availability of existing services impacts potential job upside..

Tax Revenues

The two phases of the project will generate revenue from the beginning of construction in the area. Again, the revenue numbers are presented by phase of the project. The brick and mortar or Phase I is expected to last 1.4 years.

Table 8. Phase I Brick and Mortar

Income Tax Revenues	Revenue
State Income Tax for Labor	\$14.4 Million
State and Local Sales Tax	\$19.2 Million
County Sales Taxes	\$20.3 Million
Added Business to the Economy	\$370.1 Million

Source: Semico Research Corp.

Phase II of the project begins with the installation of equipment in the fab and the addition of personnel. Following is the tax generation from Phase II.

Table 9. Phase II Production

Source	Revenue
Annual Taxes on Consumed Materials	\$14,150,453
Income Tax on Fab Jobs/Support Industry	\$ 7,696,660
Sales Taxes from W2 Spending	\$20,093,319
Multiplier Job Sales Tax	\$ 4,300,169
Multiplier Income Tax	\$ 6,732,836
Total Tax Revenue	\$52,973,437

Source: Semico Research Corp.

Additional Economic Value to the State

Phase I and Phase II have additional impact on the economy from salaries and materials. The following table shows that revenue impact.

Table 10. Labor and Materials for Phase I and II

Phase/Item	Revenue
Phase I Brick and Mortar	
Labor	\$135,000,000
Multiplier Effect	\$353,480,000
State Income Tax from Labor	\$16,339.305
Sales Tax W2 labor and Multiplier Effect	\$15,534.225
Phase II Production	
Multiplier affect	\$370,104,749
Income Taxes from W2's	\$7,696,660
State & County Sales Taxes	\$39,558,455

Source: Semico Research Corp.

Fab Economics When Operational

The cost to build and facilitate a 300mm fab is \$3 billion. Assuming Empire Zone benefits, this amount is being treated as if it were tax exempt as it pertains to property taxes. Following are employment and material consumption numbers for the fab when it is in full production.

Table 11. Fab Labor

	Jobs	Revenue
Total Direct Employment	1100	\$66,396,000
Industry Infrastructure Support	60	\$3,200,000
Total Labor	1160	\$69,596,000

Source: Semico Research Corp.

Table 12. Materials Consumption per Year

Material	Quantity	Unit Cost	Revenue
Wafers	360,000	\$150	\$54,000,000
Chemical/Gases	360,000	\$225	\$81,000,000
Power to Process Wafers kWh/cm2	1.25	\$.08	\$25,446,900
Water Gallons/year	986,486,486	\$0.00075	\$739,865
Waste Water	394,594,595	.00135	\$532,703
Total Material Costs			\$161,719,468

Source: Semico Research Corp.

The materials consumed and labor all equate to revenue generated for the state. The following table shows the yearly income that will be generated by the above when the facility is in full production.

Summary of Data

The numbers show that the addition of a semiconductor manufacturing plant would generate revenue for the state. Based on a state outlay of time, payback occurs within the first 12 months. There is an upside to this number should upstate New York be successful in adding other companies to the list in the immediate future.

Table 13. Five Year ROI

	Revenue
5-Year Direct Tax Increase	\$532,296,675
5-Year Addition to Local Economy	\$2,840,249,119
Total	\$3,372,545,793

Source: Semico Research Corp.

An ROI is calculated in the following manner:

$$(\text{Gain from investment} - \text{Cost of investment}) / \text{Cost of Investment}$$

Additionally, Semico has provided a 6-year Net Present Value of the investment compared to added benefits to the economy and increase in taxes. The NPV assumes a 4% interest rate and a \$1 billion investment from the government for incentives and infrastructure. Semico presents a 6-year Net Present Value (NPV) of the investment compared to added benefits to the economy and increase in taxes

The ROI for five years and ten years is:

- 5-yr = 466%
- 10-yr = 609%

Alternatively, one can look at in a Net Present Value Analysis where the investment outlay is assumed to be in the beginning of the project and the returns occur over time and a discount rate is applied to the future stream of benefits to adjust the

dollar value back to constant dollars. In this analysis a discount rate of 4% is use over the 6-year time frame.

The NPV calculation assumes a \$650 million inflow from the state and an offsetting economic benefit of \$300 million from construction followed by 4 years of economic benefit from plant production. The five-year NPV of the state’s \$650 million investment from additional revenue is \$129 million. Adding in increased economic value to the region the NPV jumps up to \$1.88 billion.

The cost of jobs for New York State assuming \$650,000,000 investment would be as follows.

- The cost per job of \$117,884 includes:
 - Construction Personnel
 - Fab
 - Support Industry
 - Local Business Jobs

Table 14. Ten-Year ROI

	Revenue
10 year State direct tax* revenue increase:	\$711,773,111
10 year County direct tax* revenue increase:	\$414,028,530
10 year additional GDP from multiplier effect:	\$5,678,840,086

Source: Semico Research Corp.

*sales/income tax for consumables in the fab and increased purchases by new consumers

Yearly Return on Investment

The state does not wait until Year Five or more to see a return on investment. Benefits of the location and start of construction on the semiconductor fab begin in Year One. The following table presents the State Revenue and added GDP. Over a

ten year period, close to \$4 billion is generated in New York state revenue. The yearly detail is presented in the following table.

Table 15. Yearly Return on Investment

	State Revenue	Added GDP	Total
Year 1	\$23,884,500	\$353,480,000	\$377,364,500
Year2	\$40,516,680	\$537,990,331	\$578,507,012
Year 3	\$41,732,181	\$554,130,041	\$595,862,223
Year 4	\$42,984,147	\$570,753,943	\$613,738,089
Year 5	\$44,273,671	\$587,876,561	\$632,150,232
Year 6	\$45,601,881	\$605,512,858	\$651,114,739
Year 10	\$51,325,318	\$681,510,056	\$732,835,375

Source: Semico Research Corp.

Breakeven

The breakeven period for the investment that the State of New York would be required to attract a semiconductor fab to Upstate New York begins in the first 12 months. The breakeven calculation is based upon the following:

- Summing the value of additional taxes
- Plus the additional value added to local economy
 - Similar to calculating value additions to GDP
- Includes the value of construction and the fab starting operation and moving to full production

This report presents substantial and necessary statistics and facts about the semiconductor industry. The number of jobs that can be created by the establishment of a semiconductor facility in the Upstate New York area is impressive. Additionally, the enhanced levels of employment and income would be a definite plus to the tax coffers of the state.