

Putting Nanotechnology on the Map

(Updated June 2009)

Executive Summary

Nanotechnology has the potential to play a key role in local economic development throughout the world over the coming decades. The emergence of nanotechnology clusters, where companies are linked by common markets, labor pools, and similar technologies, is already well-underway in the United States. Whether these clusters will gain performance advantages through co-location and have significant impacts on local economies is yet to be determined, but the identification of emerging pockets of activity is an important first step in the development of strategies to improve local innovation and stimulate employment growth as well as to provide for the protection of human health and the environment from accidental releases and exposure to nanomaterials manufactured and used by industries and laboratories.¹ These emerging clusters may benefit from place-based economic development strategies already being used in states such as California, Texas, Oregon, Arizona, Minnesota, Pennsylvania, and Connecticut.

To explore how and where nanotechnology is being developed and commercialized in the United States, the Project on Emerging Nanotechnologies (PEN) has compiled publicly available data to examine the locations of companies, universities, government laboratories, and other organizations located in the United States and working in nanotechnology. When the map was first launched in 2007, it included a little over 800 entries. The map now includes 955 companies, 182 university and government laboratories, and 81 other types of organizations.

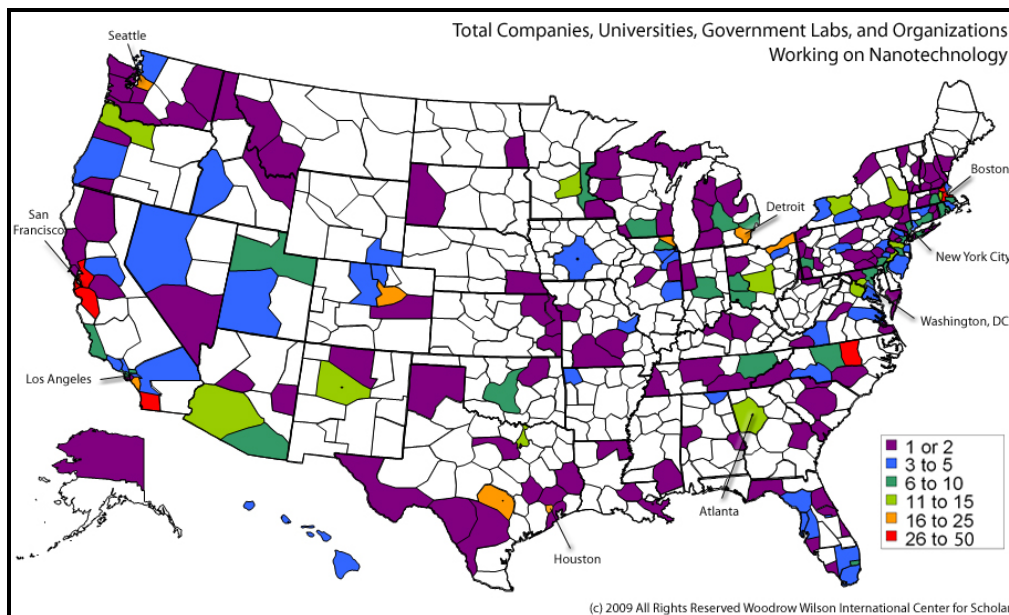


Figure I. Number of companies, universities, government laboratories, and/or organizations working in nanotechnology and located in each 3-digit zip code Nano Metro (1218 Total).

¹ Edit submitted by Mark Eads, Economist, US Environmental Protection Agency, Office of Resource Conservation & Recovery.

In the following analysis, states and 3-digit zip code "Nano Metros" are ranked based on the number of entries they contain. In addition, 8 sectors are used for the classification of entries with each entry getting one sector based on its primary focus of work as determined by its website. Companies are split into the following 6 sectors:

- Electronics;
- Energy and Environmental Applications;
- Imaging and Microscopy;
- Materials;
- Medicine and Health; and
- Tools and Instruments.

Universities and government laboratories are grouped under: Academic and Government Research. Nonprofits, think tanks, and professional organizations are simply grouped under the sector: Organization. More information on the methodology and sectors is available in the appendix.

Main Findings

- All 50 states and the District of Columbia have been found to contain at least one company, university, government laboratory, or organization working in nanotechnology, showing that nanotechnology activities are occurring throughout the United States.
- The top 4 states overall (each with over 75 entries) remain the same from 2007. They are California, Massachusetts, New York, and Texas. These states also remain the top 4 states in terms of Companies and Academic and Government Research. Massachusetts and Texas have joined California, New York, Ohio and the District of Columbia as having the most organizations working in nanotechnology.
- The top 6 Nano Metros (each with 30 or more entries) are: Boston, MA; San Francisco, CA; San Jose, CA; Raleigh, NC; Middlesex-Essex, MA; and Oakland, CA.
- The top 3 sectors of companies working in nanotechnology (each with over 200 entries) are: materials, tools and instruments, and medicine and health.
- The number of universities and government laboratories working in nanotechnology is still significant, as it was in 2007, with 182 identified.
- California maintains its lead in terms of the most entries, maintaining its margin of double the number of entries of any other state. Ohio and North Carolina have both broken into the top 10 states. They have also moved into the top 10 for the number of companies. Pennsylvania and North Carolina have moved into the top 10 for the number of organizations.
- Boston, MA, and San Francisco, CA, have taken the lead as the top Nano Metros from San Jose, CA. Raleigh, NC, has moved into the top 5 Nano Metros (displacing Oakland, CA).
- There are now more Tools and Instruments and Medicine and Health companies than entries participating in Academic and Government Research.

State and Sector Analysis

Rankings are based on the number of entries in each state or sector. For simplicity, the District of Columbia is classified as a state for this analysis.

Top States:

2009	2007
<ol style="list-style-type: none"> 1. California – 231 entries 2. Massachusetts – 114 entries 3. New York – 82 entries 4. Texas – 79 entries 5. Pennsylvania – 58 entries 6. Ohio – 54 entries 7. Florida – 50 entries 8. North Carolina – 48 entries 9. New Jersey – 42 entries 10. Illinois – 40 entries 11. Michigan – 37 entries 12. Washington – 35 entries 13. Maryland – 26 Entries 14. Colorado; Connecticut – 25 entries 	<ol style="list-style-type: none"> 1. California – 161 entries 2. Massachusetts – 80 entries 3. New York – 61 entries 4. Texas – 55 entries 5. Pennsylvania – 35 entries 6. Michigan – 28 entries 7. Illinois; New Jersey – 27 entries 8. Florida – 26 entries 9. Ohio – 25 entries 10. Colorado – 24 entries 11. Washington – 23 entries

Top States for Companies:

2009	2007
<ol style="list-style-type: none"> 1. California – 199 entries 2. Massachusetts – 95 entries 3. Texas – 60 entries 4. New York – 58 entries 5. Pennsylvania – 45 entries 6. Florida – 44 entries 7. Ohio – 41 entries 8. North Carolina – 37 entries 9. New Jersey – 34 entries 10. Illinois – 31 entries 	<ol style="list-style-type: none"> 1. California – 136 entries 2. Massachusetts – 69 entries 3. New York; Texas – 43 entries 4. Pennsylvania – 29 entries 5. Florida; New Jersey – 24 entries 6. Illinois; Michigan – 21 entries 7. Colorado – 20 entries

Top States for Academic and Government Research:

2009	2007
<ol style="list-style-type: none"> 1. New York – 17 entries 2. California – 15 entries 3. Massachusetts – 13 entries 4. Texas – 11 entries 5. Virginia – 9 entries 6. Pennsylvania; North Carolina – 8 entries 7. District of Columbia; Illinois; Michigan; Maryland; Ohio – 7 entries 	<ol style="list-style-type: none"> 1. California – 15 entries 2. New York – 12 entries 3. Texas – 10 entries 4. Massachusetts – 9 entries 5. Virginia – 8 entries 6. Maryland – 6 entries 7. District of Columbia; Illinois; Michigan; New Mexico; Pennsylvania; Washington – 5 entries

Top States for Organizations:

2009	2007
<ol style="list-style-type: none"> 1. California – 17 entries 2. Texas – 8 entries 3. New York – 7 entries 4. Massachusetts; Ohio; District of Columbia – 6 entries 5. Pennsylvania – 5 entries 6. North Carolina; Michigan; Oklahoma – 3 entries 	<ol style="list-style-type: none"> 1. California – 10 entries 2. District of Columbia; New York – 6 entries 3. Ohio – 3 entries 4. Connecticut; Massachusetts; Michigan; Oklahoma; Texas – 2 entries

Top Sectors:

2009	2007
<ol style="list-style-type: none"> 1. Materials – 305 entries 2. Tools and Instruments – 216 entries 3. Medicine and Health – 205 entries 4. Academic and Government Research – 182 entries 5. Electronics – 107 entries 6. Organization – 81 entries 7. Energy and Environmental Applications – 72 entries 8. Imaging and Microscopy – 50 entries 	<ol style="list-style-type: none"> 1. Materials – 218 entries 2. Academic and Government Research – 138 entries 3. Medicine and Health; Tools and Instruments – 133 entries 4. Electronics – 69 entries 5. Energy and Environmental Applications – 48 entries 6. Organization – 45 entries 7. Imaging and Microscopy – 36 entries

Nano Metro Analysis

Rankings are based on the number of companies, universities, government laboratories, and/or organizations located in each 3-digit zip code Nano Metro and working in nanotechnology. Names for each 3-digit zip code Nano Metro have been determined using the United States Postal Service 3-Digit Zip Code Prefix Matrix (<http://pe.usps.gov/text/dmm300/L002.htm>).

Top Nano Metros:

2009	2007
<ol style="list-style-type: none"> 1. Boston, MA; San Francisco, CA – 48 entries 2. San Jose, CA – 46 entries 3. Raleigh, NC – 34 entries 4. Middlesex-Essex, MA – 31 entries 5. Oakland, CA – 30 entries 6. San Diego, CA – 27 entries 7. Seattle, WA – 25 entries 8. Austin, TX; Houston, TX – 24 entries 9. Chicago, IL; Santa Ana, CA – 23 entries 10. Worcester, MA – 22 entries 11. Los Angeles, CA – 20 entries 	<ol style="list-style-type: none"> 1. San Jose, CA – 38 entries 2. Boston, MA – 36 entries 3. San Francisco, CA – 31 entries 4. Oakland, CA – 22 entries 5. Middlesex-Essex, MA – 21 entries 6. San Diego, CA – 20 entries 7. Austin, TX; Denver, CO; Houston, TX – 18 entries 8. Chicago, IL; Santa Ana, CA; Seattle, WA – 15 entries

Top Nano Metros for Academic and Government Research:

2009	2007
<ol style="list-style-type: none"> 1. Boston, MA – 9 entries 2. Washington, DC – 7 entries 3. Houston, TX – 6 entries 4. Raleigh, NC; Albuquerque, NM – 5 entries 5. Chicago, IL; New York, NY; Albany, NY; Northern VA – 4 entries 6. 5 Nano Metros – 3 entries 7. 24 Nano Metros – 2 entries 8. 72 Nano Metros – 1 entry 	<ol style="list-style-type: none"> 1. Boston, MA – 7 entries 2. Houston, TX – 6 entries 3. Albuquerque, NM; Washington, DC – 5 entries 4. Northern VA; Raleigh, NC – 4 entries 5. 6 Nano Metros – 3 entries 6. 16 Nano Metros – 2 entries 7. 64 Nano Metros – 1 entry

Top Nano Metros for Electronics:

2009	2007
<ol style="list-style-type: none"> 1. San Jose, CA – 10 entries 2. San Francisco, CA – 10 entries 3. Middlesex-Essex, MA – 5 entries 4. Raleigh, NC; Worcester, MA; Minneapolis, MN – 4 entries 5. Oakland, CA; Rochester, NY; Phoenix, AZ – 3 entries 6. 13 Nano Metros – 2 entries 7. 35 Nano Metros – 1 entry 	<ol style="list-style-type: none"> 1. San Jose, CA – 9 entries 2. San Francisco, CA – 6 entries 3. Minneapolis, MN – 4 entries 4. Middlesex-Essex, MA – 3 entries 5. Oakland, CA – 3 entries 6. 11 Nano Metros – 2 entries 7. 22 Nano Metros – 1 entry

Top Nano Metros for Energy and Environmental Applications:

2009	2007
<ol style="list-style-type: none"> 1. San Francisco, CA; Detroit, MI – 4 entries 2. Seattle, WA; Cheyenne, WY – 3 entries 3. 12 Nano Metros – 2 entries 4. 34 Nano Metros – 1 entry 	<ol style="list-style-type: none"> 1. Detroit, MI – 4 entries 2. 7 Nano Metros – 2 entries 3. 30 Nano Metros – 1 entry

Top Nano Metros for Imaging and Microscopy:

2009	2007
<ol style="list-style-type: none"> 1. San Jose, CA – 4 entries 2. San Francisco, CA – 3 entries 3. 9 Nano Metros – 2 entries 4. 25 Nano Metros – 1 entry 	<ol style="list-style-type: none"> 1. Madison, WI; Oakland, CA; Phoenix, AZ; San Jose, CA; Seattle, WA – 2 entries 2. 26 Nano Metros – 1 entry

Top Nano Metros for Materials:

2009	2007
<ol style="list-style-type: none"> 1. Boston, MA – 14 entries 2. Santa Ana, CA – 11 entries 3. San Francisco; Seattle, WA – 9 entries 4. San Diego, CA; Chicago, IL; Cleveland, OH – 7 entries 5. 5 Nano Metros – 6 entries 6. 7 Nano Metros – 5 entries 7. 5 Nano Metros – 4 entries 8. 19 Nano Metros – 3 entries 9. 26 Nano Metros – 2 entries 10. 47 Nano Metros – 1 entry 	<ol style="list-style-type: none"> 1. Boston, MA – 12 entries 2. Santa Ana, CA – 7 entries 3. San Jose, CA; Worcester, MA; Detroit, CO – 6 entries 4. 7 Nano Metros – 5 entries 5. Albany, NY – 4 entries 6. 12 Nano Metros – 3 entries 7. 25 Nano Metros – 2 entries 8. 56 Nano Metros – 1 entry

Top Nano Metros for Medicine and Health:

2009	2007
<ol style="list-style-type: none"> 1. Boston, MA – 15 entries 2. Middlesex-Essex, MA – 10 entries 3. San Francisco, CA; Raleigh, NC – 8 entries 4. San Diego, CA; Chicago, IL – 7 entries 5. Oakland, CA; Austin, TX; Suburban MD – 6 entries 6. Pasadena, CA – 5 7. 4 Nano Metros – 4 entries 8. 11 Nano Metros – 3 entries 9. 18 Nano Metros – 2 entries 10. 42 Nano Metros – 1 entry 	<ol style="list-style-type: none"> 1. Boston, MA – 11 entries 2. Middlesex-Essex, MA; San Diego, CA; San Francisco, CA – 7 entries 3. Chicago, IL; Oakland, CA – 5 entries 4. Austin, TX; Waterford, CT – 4 entries 5. Houston, TX; Raleigh, NC; Santa Ana, CA; Suburban MD – 3 entries 6. 15 Nano Metros – 2 entries 7. 41 Nano Metros – 1 entry

Top Nano Metros for Organizations:

2009	2007
<ol style="list-style-type: none"> 1. San Francisco, CA; New York, NY; Washington, DC – 6 entries 2. San Jose, CA; Houston, TX – 4 entries 3. 6 Nano Metros – 3 entries 4. 5 Nano Metros – 2 entries 5. 27 Nano Metros – 1 entry 	<ol style="list-style-type: none"> 1. Washington, DC – 6 entries 2. New York City, NY – 5 entries 3. San Francisco, CA; San Jose, CA – 4 entries 4. Boston, MA; Cleveland, OH; Oklahoma City, OK – 2 entries 5. 20 Nano Metros – 1 entry

Top Nano Metros for Tools and Instruments:

2009	2007
<ol style="list-style-type: none"> 1. San Jose, CA – 20 entries 2. Oakland, CA – 9 entries 3. Austin, TX – 8 entries 4. Middlesex-Essex, MA; San Diego, CA – 7 entries 5. San Francisco, CA; Portland, OR – 6 entries 6. 4 Nano Metros – 5 entries 7. 7 Nano Metros – 4 entries 8. 12 Nano Metros – 3 entries 9. 16 Nano Metros – 2 entries 10. 37 Nano Metros – 1 entry 	<ol style="list-style-type: none"> 1. San Jose, CA – 14 entries 2. Austin, TX – 6 entries 3. Portland, OR – 5 entries 4. 7 Nano Metros – 4 entries 5. 8 Nano Metros – 3 entries 6. 9 Nano Metros – 2 entries 7. 38 Nano Metros – 1 entry

Appendix

I. Methodology

Companies, universities, government laboratories, and other organizations included in these maps were found via publicly available data listed through:

- www.nanovip.com, an online directory of nanotechnology companies;
- The 2007 SmallTimes Business Directory;
- An article in *Chemical & Engineering News*, entitled "Building Up Nanotech Research" (April 19, 2007); and
- Research conducted in conjunction with PEN's Consumer Products Inventory (available here: <http://www.nanotechproject.org/44>).

Entries located in the United States have been the primary focus of this project. Excluded from the maps are any financial/capital venture firms. Information included in the inventory has been re-confirmed via the company, university, government laboratory, or organization's website. For an entry to have been included, nanotechnology is mentioned in some capacity on its website. We have made no attempt to verify company, university, government laboratory, or organization claims about their work in nanotechnology.

A. Sectors

Each company, university, government laboratory, and organization is assigned a "Sector." Each entry was given only one sector, based on its primary focus of work as determined by its website. The following subcategories were generally used to determine sector:

1. Academic and Government Research
Includes universities and government laboratories.
2. Electronics
Includes work in computer hardware, display, robotics, semiconductors, etc.
3. Energy and Environmental Applications
Includes work in automotives, fuel cells, batteries, MEMS, etc.
4. Imaging and Microscopy
Includes work in optics, etc.
5. Materials
Includes work in buckytubes, nanocoatings, nanoparticles, nanocomposites, nanopowders, nanocrystals, nanotubes, thin films, chemistry, fabrics, etc.
6. Medicine and Health
Includes work in nanobiotechnology, drugs, medical devices, skin treatments, etc.
7. Organization
Includes non-profits, think tanks, professional organizations, etc.
8. Tools and Instruments

Includes work in computer software, nanolithography, manufacturing tools, etc.

B. Creating the Maps

Static maps have been created using Mapland software. This software program provides the ability to create maps of the entire United States, which indicate the number of companies, universities, government laboratories, and organizations located in each state by the 3-digit zip code (the first three digits of the 5-digit zip code). Names of each 3-digit zip code Nano Metro have been determined using the United States Postal Service 3-Digit Zip Code Prefix Matrix (<http://pe.usps.gov/text/dmm300/L002.htm>).

II. Map Data

Information about companies, universities, government laboratories, and organizations included in the maps is available here: http://www.nanotechproject.org/process/assets/files/8262/map_data.pdf.

III. Getting on the Map (Updates)

Users are encouraged to submit new information or changes at: <http://www.nanotechproject.org/inventories/map/submit/>.

For questions on methodology or analysis, please contact Natalie Chin at natalie.chin@wilsoncenter.org.