"Developing a Hydrogen Powered Economy in New York State"

Status Review for HTAC

"Work in Process"

June 15, 2011

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What About NY?

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- State Assemblyman Joseph Morelle has quietly been building momentum over the last 2 years to develop a partnership capable of supporting initial Fuel Cell vehicle commercialization as well as jobs creation in the 2015 timeframe and beyond
- There is a clear understanding that FCVs will be placed where there is hydrogen
- Assemblyman Morelle has developed a public- private partnership with the NYS Legislature, the major Fuel Cell vehicle OEM developers, H2 Infrastructure suppliers, NYSERDA, Brookhaven National lab, Academia, and other relevant parties to work together to bring forth a commercialization plan within NY
- The Partnership is using as its foundation the "NY Hydrogen Highway" originally conceived in 2006 by NYSERDA. The premise was to build the state out in clusters and then link them by the major interstates
- The plan is in the 1st level of detailing phase at this point and a draft plan was reviewed with the NY legislature on June 7th – complete w/a FCEV Ride & Drive with 4 OEM vehicles

Assemblyman Morelle Review on June 7, 2011

By JOSEPH SPECTOR
Gannett Albany Bureau Chief
ALBANY -- Four hydrogen fuel cell vehicles lined State Street outside the state Capitol on Tuesday as a Rochester-area assemblyman sought to build support for making the technology a key economic-development effort in New York.

Assemblyman Joseph Morelle, D-Irondequoit, Monroe County, said bringing the cars to Albany would hopefully build state support for the technology, which is being developed in part by General Motors in Honeoye Falls, Monroe County.

"The goal was to try to develop this and how the state of New York can be the global leader in the development of fuel cells and also hopefully the manufacturing of fuel cells," said Morelle, who took one of the cars for a drive around the Capitol.

NY Job Creation

In February, 2011, the US Department of Energy released a comprehensive study concluding that the fuel cell and hydrogen industries could generate substantial revenues and job growth. Over the next two decades, assuming hydrogen does indeed play a central role in our energy future (an assumption which is still very likely, despite the US falling behind other nations), it would create **between 360,000 and 675,000 jobs**.

Should New York State see but 10 percent of the benefit from this economic growth, it would still translate to the creation of between 36,000 and 67,500 jobs over two decades. When looking at the public expenditure this proposal calls for, the return on investment would be substantial.

Fuel Cell Vehicles are Coming – This is NOT the Question – NY Gets That

- Major Auto OEMs are in the execution phase of 2015 commercial programs.
- The world outside of the US is supporting this technology.
- The vehicles will be placed where there is fuel – Germany & Japan now.
- The commercialization of this new Technology brings with it the state of art Automotive and H2 Infrastructure commercial partners and the potential of jobs associated with it.
- It brings to NY "if we do this", a recognition of Leadership within both the US and Globally.
- NY has a fledgling H2 Infrastructure we have to preserve until the 2015 introductions.

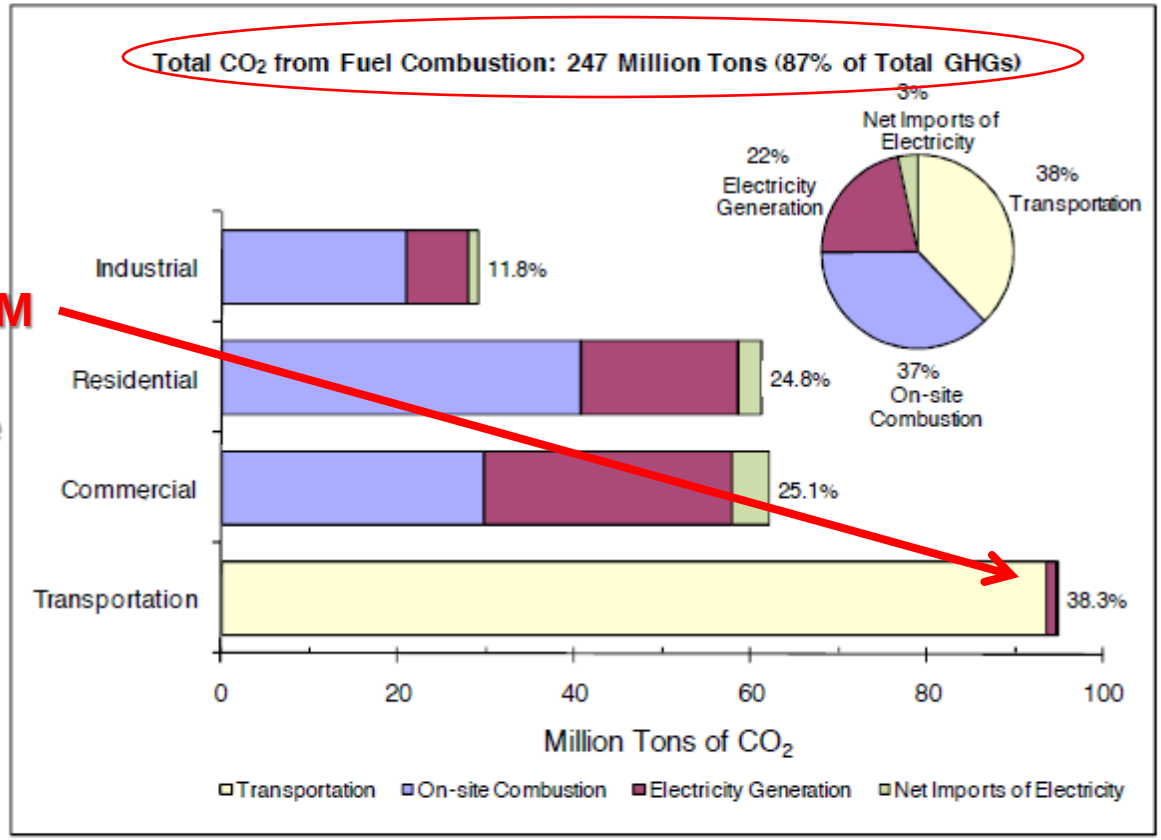
Addressing Greenhouse Gas Emissions in NY

- Executive Order sets a goal for 80% reduction of greenhouse gas (GHG) emissions by 2050

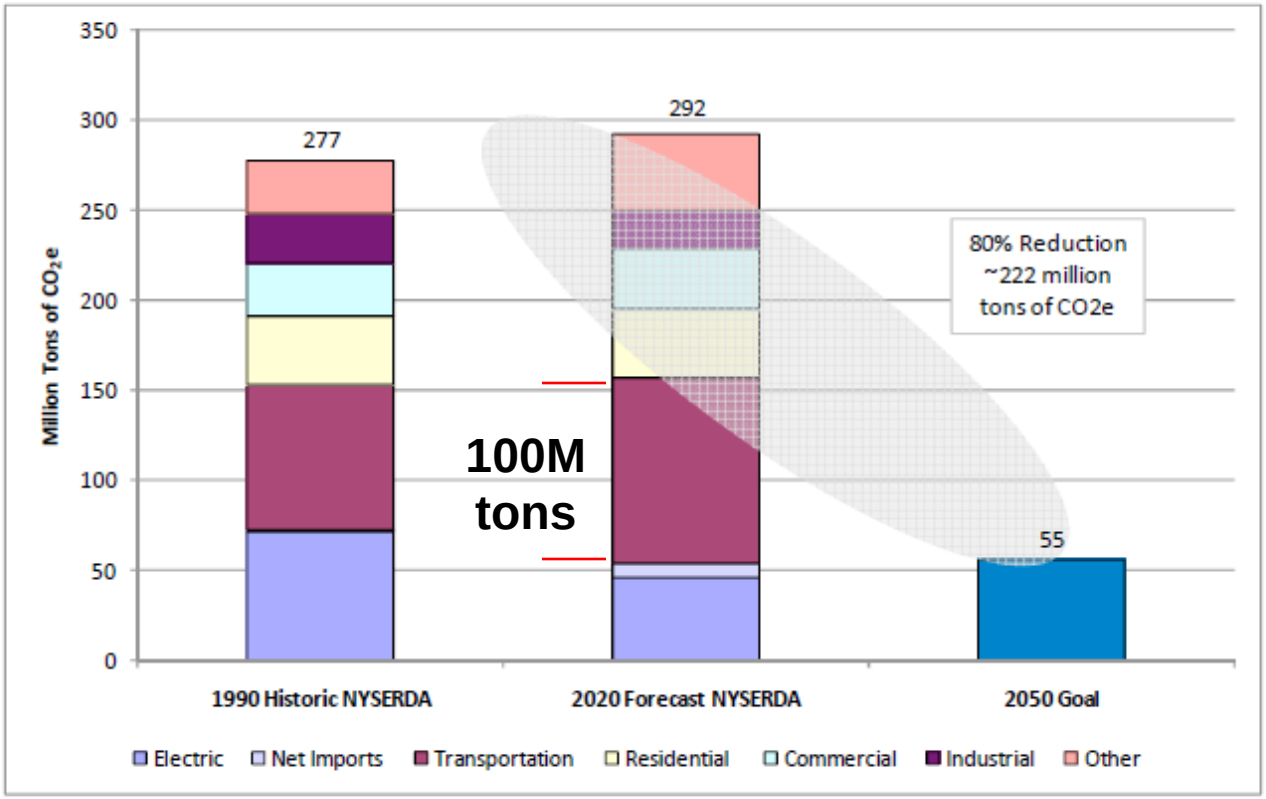
- State Planning Legislation in place that requires developing an inventory of GHG emissions and identification of GHG reduction strategies

CO2 from Fuel Combustion by End Use Sector (2007)

95M tons of CO2 is equivalent to more than 42M Volts or 63M Prius into the atmosphere



GHG Emission Reductions Required to Meet 2050 Goal (80X50)



Appendix B

GHG Emissions Scenario Assumptions From Brookhaven National Lab Study for CAC

Sector	Yellow	Deep Blue 53 MMT	55 MMT Ultraviolet
Transportation	Smart growth reduces VMT Demand 10% for LDV Fleet mix composed of CV/HEV/PHEV* = 30/30/40 CV reaches 37 mpg; HEV miles at 50mpg 95% of VMT for PHEV are all-electric 50% of HDV miles switch to freight transport by rail 30% efficiency gains in aviation ~51.3 MMT CO2e	Smart growth reduces VMT demand 40% for LDV **100% of VMT for LDV from hydrogen (nuclear-based) @65 mpg equivalent** 50% HDV VMT switch to freight transport to rail; 40% of balance of miles from biodiesel 30% efficiency gains in aviation, 50% reduction of aviation emissions from biofuel **~15 MMT CO2e**	Smart growth reduces VMT demand 40% for LDV **95% of VMT from LDV are all-electric miles** **Balance of LDV VMT 50 mpg with in-state E85/biodiesel** 50% HDV VMT switch to freight transport to rail 30% efficiency in aviation sector; 50% reduction of aviation emissions from biofuel **~20 MMT CO2e**
Electricity	25% electricity efficiency in Residential 25% electricity efficiency in Commercial 10% electricity efficiency in Industrial Minimize combustion; what is left switches to IGCC, NGCC w/ CCS Max hydro, wind No new nuclear NO NEW OUT OF STATE RENEWABLE ELECTRICITY ~21 MMT CO2e	Significant efficiency gains as in Yellow Scenario Eliminate all combustion Maximize hydro 30% from carbon-free (nuclear [+2 new plants producing 25K GWh] + hydro) 30% from renewables (utility-scale solar (100,000 GWh), max wind) 40% from NGCC and CCS (@90%) H2 via electrolysis of high-temperature steam using high-T gas-cooled reactors (5-8 plants) NO NEW OUT OF STATE RENEWABLE ELECTRICITY **~13 MMT CO2e**	Significant efficiency gains as in Yellow Scenario Maximize hydro, max wind 35% from carbon-free (nuclear [15 new nuclear plants; 24 total], max hydro) 35% from renewables (utility scale solar (100,000 GWh), wind) 17% from NGCC and CCS (@90%) 35%- 40% energy demand in Res./Comm from local solar NO NEW OUT OF STATE RENEWABLE ELECTRICITY ~10 MMT CO2e
Residential	20% efficiency gains in energy demand for heat/hot water 10% of electricity needs met from local solar Reduce combustion by 70-80% ~7.5 MMT CO2e	30% reduction in energy demand through efficiency 50% delivered gas/liquid fuels from biomass 40% of balance of energy demand left met by local solar generation Balance to energy demand from grid **ZERO MMT CO2e**	50% reduction in energy demand through efficiency Eliminate all combustion of gas, oil 40% of balance of energy demand met by local solar PV ZERO MMT CO2e
Commercial	Reduce natural gas/oil combustion by 75% 10% of electricity needs met from local solar Balance of energy need shifted to central electricity ~4.5 MMT CO2e	20%-30% efficiency gains 50% delivered liquids fuels from biomass ~30% of electricity demand from local solar Balance of energy need shifted to central electricity **ZERO MMT CO2e**	20%-30% reduction in energy demand through efficiency Eliminate all combustion of gas, oil ~ 50% of energy demand from local solar Balance of energy need shifted to central electricity ZERO MMT CO2e

What does this Mean for NY?

✓NY is taking on a leadership role in setting a vision to implement Green Technologies to address the 2050 goals. This Climate Action Council was co-led by Alan Belensz (NYS Department of Environmental Conservation) and Janet Joseph (NYSERDA)

✓Clearly, combustion of Fossil Fuel accounts for almost 90% of NYS C02 emissions – much of it from Transportation

✓The projections out into 2020 already include the new CAFÉ standards

✓To get to the 2050 levels will require Zero Emission Vehicles (ZEVs)

✓NY has the opportunity in front of it to not only be a National leader in this area in regards to developing and implementing H2 Fuel Cell Technology and H2 infrastructure for Automobiles, but to also position the US competitively globally with Germany and Japan

✓We will need a cohesive plan state wide to pull this off that will include Gov't, Auto OEMs, Energy Providers, and the Academic sector

Next Steps for NY

✓New York needs to address 80x2050 in a comprehensive way – this could be a lead into retaining current high tech jobs as well as developing new "green" ones across the state – before they go somewhere else.

✓ZEV Vehicles have been indentified globally as part of the solution to the problem and other countries are executing their programs around FCVs as you have seen today

✓New York has the US leading Auto OEM Fuel Cell developer in the GM/HF facility. It is our only competition to the rest of the word – 350 green/high tech jobs in NY. More jobs will follow from the overall industry.

✓New York already has "some" Hydrogen Infrastructure in place as well as a plan from NYSERDA that is being updated with the latest assumptions

✓Next steps would be the development of a plan to assist in the early commercialization of both OEM FCVs **AND** Hydrogen Infrastructure across the state to position NY as a leader. This can be a model for other states (California & Hawaii are already in process of moving forward with a plan like this) as well as for the country. This would help to address the "Bridge to Growth" experienced by all new technologies in their early implementation.

✓The US is already behind the rest of the world (they are doing it) – we need a **PLAN** and a sense of urgency moving forward. **Other countries are developing both their Industrial Competiveness and Energy Security policies – what is ours? We are behind.**

The Program "Plan" Outline

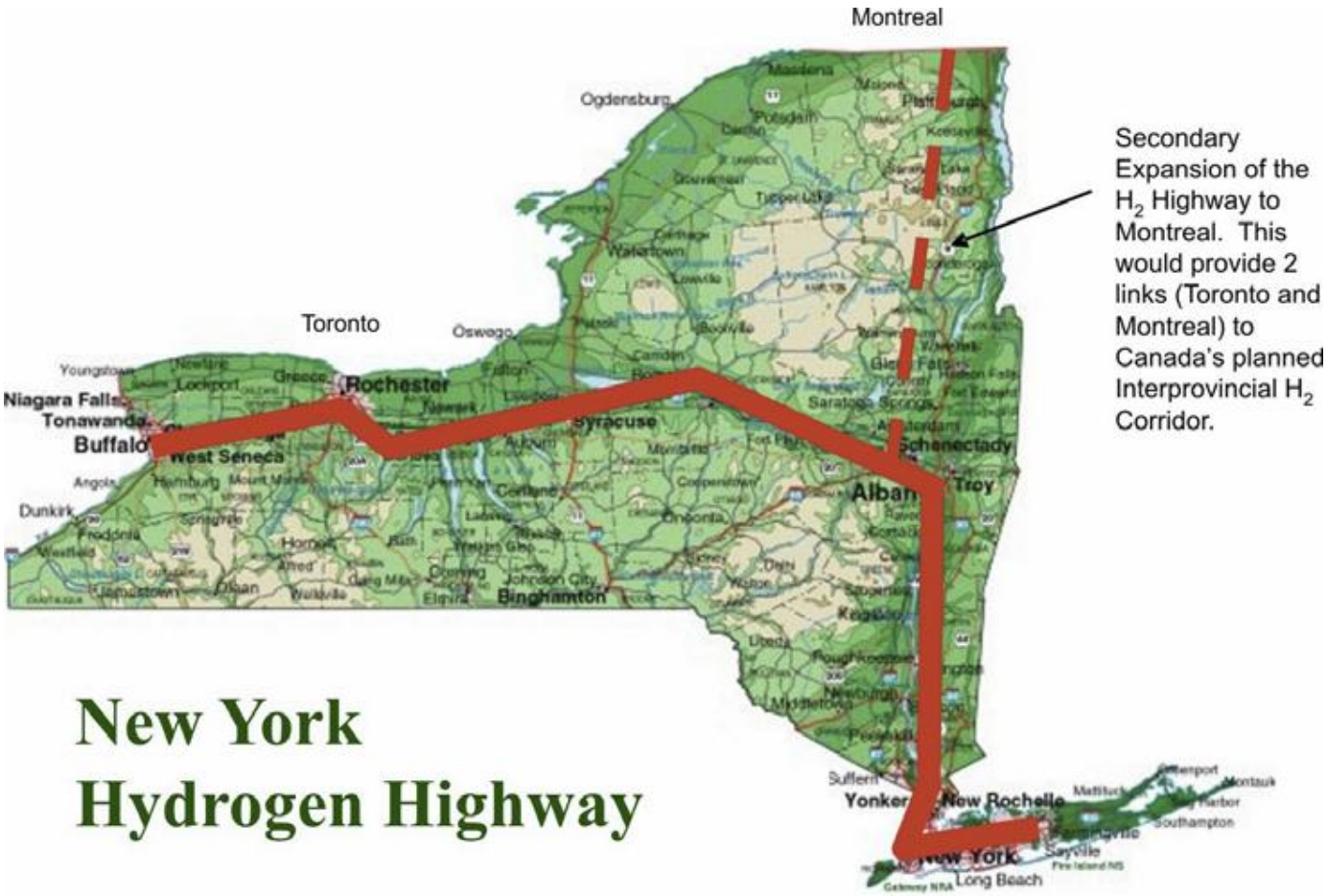
- Background
- Objective
- Public/Private Partnership
- Program Development timing
- Proposed Infrastructure Rollout (2 Options)
- Automotive OEM Vehicle Needs
- Financial Support for Infrastructure Rollout
- Customer/Fleet Vehicle Incentives for 2015-2020 timeframe
- Summary/Next Steps

Background

- NY State has developed a cohesive vision to achieve an 80% reduction in CO2 by 2050 - http://www.nyclimatechange.us/index.cfm
- In the transportation sector three technologies have been identified to meet these objectives - Bio-Fuels, Batteries/Plug-ins/Hybrids, and Fuel Cells
- Germany and Japan have announced Public/Private partnerships to launch Fuel Cell Vehicles (FCEVs) in 2015 in their countries
- To execute the vehicle programs six Auto OEMs are investing approximately $500M each thru 2015 for a combined private investment cost of close to **$3.0Billion**
- NY State participation in a 100 H2 station plan would require an investment of approximately **$50M** to support the Auto OEM rollout in the early stages – a fraction of the OEM's investment. NYS would also need to support Fed incentives for these vehicles that would currently amount to approx. **$165M**
- OEMs have indicated that FCEVs will be sold where the H2 stations are located
- The federal government is **not** taking a leadership role driving the US to fall behind Germany & Japan from a technology/commercialization perspective
- NY is in a position to help develop the infrastructure, demonstrate national leadership, and participate in the jobs creation that the introduction of a new, game changing technology would provide

Objective

Utilize the H2 Highway concept conceived by NYSERDA and refine/update it based on current industrial plans and technology developments to support early US/NY commercial vehicle deployment in the years 2015 -2020



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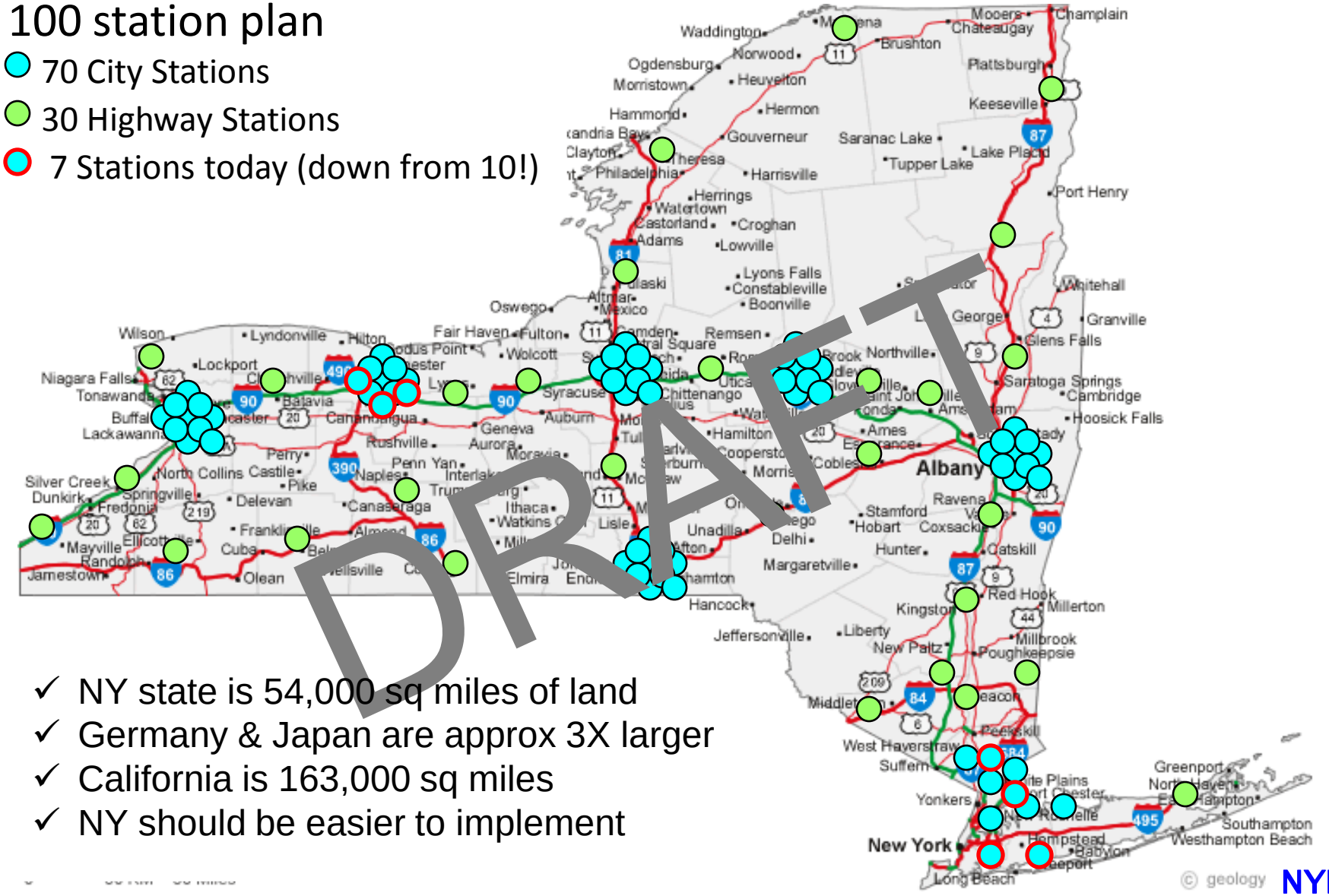
Plan for New York State Hydrogen Highway and Connecting City Plan in Support of early FCEV Deployment – 2015-2020

100 station plan

- 70 City Stations
- 30 Highway Stations
- 7 Stations today (down from 10!)



- ✓ NY state is 54,000 sq miles of land
- ✓ Germany & Japan are approx 3X larger
- ✓ California is 163,000 sq miles
- ✓ NY should be easier to implement

Proposed Infrastructure Rollout

Calendar Year	Min # Cars Required	Total Cars in NY	Fed Gov't Incentive per car ($k)	Total Gov't Incentive ($k)	Number of Cities in Program	City cluster station total	Total Highway station #	Yearly new station #	Estimate Station cost	Total Station Cost ($M)	Station funding % cost share	NYS Investment	*Total NY/Fed Cost ($M)
2015	1500	1500	7.5	11250	2	20	0	20	2.2	44	0.5	22	33.25
2016	3000	4500	7.5	22500	3	30	5	15	2.2	33	0.4	13.2	35.7
2017	5000	9500	5	25000	4	40	10	15	1.8	27	0.3	8.1	33.1
2018	8000	17500	3.5	28000	5	50	15	15	1.4	21	0.2	4.2	32.2
2019	12500	30000	3	37500	6	60	20	15	1.1	16.5	0.1	1.65	39.15
2020	20000	50000	2	40000	7	70	30	20	0.8	16	0.1	1.6	41.6
Total		**50000**		**164250**	**7**	**70**	**30**	**100**		**157.5**		**50.75**	**215**

Goals: Lead in Industry Vehicle Deployment, H2 Filling Stations, etc.

7 cities by 2020 - Albany, Rochester, NY City, Buffalo, Syracuse, Binghamton, Utica, Hwy

100 stations by 2020 (10 per city) = 70 + 5 per year on connecting "Highway" (30 hwy Total)

50,000 total cars by 2020

*** Includes anticipated $164,250,000 Federal Customer Vehicle Incentive currently in place for Adv Technology vehicles**

2015 – Initial NYC (10) and Upstate City #1 (10) for initial launch
2016 – Add Upstate City #2 (10) and add 5 highway station along Thruway
2017 – Add Upstate City #3 (10) and add 5 highway stations
2018 – Add Upstate City #4 (10) and add 5 highway stations
2019 – Add Upstate City #5 (10) and add 5 highway stations
2020 – Add Upstate City #6 (10) and add last 10 highway stations

**** Station location selection based on input from Greet/Street Model***

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