

“A Well-Conceived Experimental Installation”: Possible NH₃ Fuel Transportation Demonstration Projects



7th Annual NH₃ Fuel Conference

SEPTEMBER 27, 2010



CLINTON CLIMATE INITIATIVE

“In the case of anhydrous ammonia [one] of the more important recommendations for further work would be a well-conceived and carefully documented experimental installation of ammonia fuel I.C.E.’s in specific applications.”

- Chemetics International report on NH₃ fuel, as quoted by Greg Vezina at the 2007 Ammonia Fuel Conference

CLINTON CLIMATE INITIATIVE OVERVIEW

CITIES
>60%

CLEAN ENERGY
60%

FORESTRY
15%

CLINTON CLIMATE INITIATIVE OVERVIEW

CITIES

CLEAN ENERGY

- Carbon Capture and Sequestration
- Utility-Scale Solar Thermal

FORESTRY

- Measuring, Reporting, and Verification

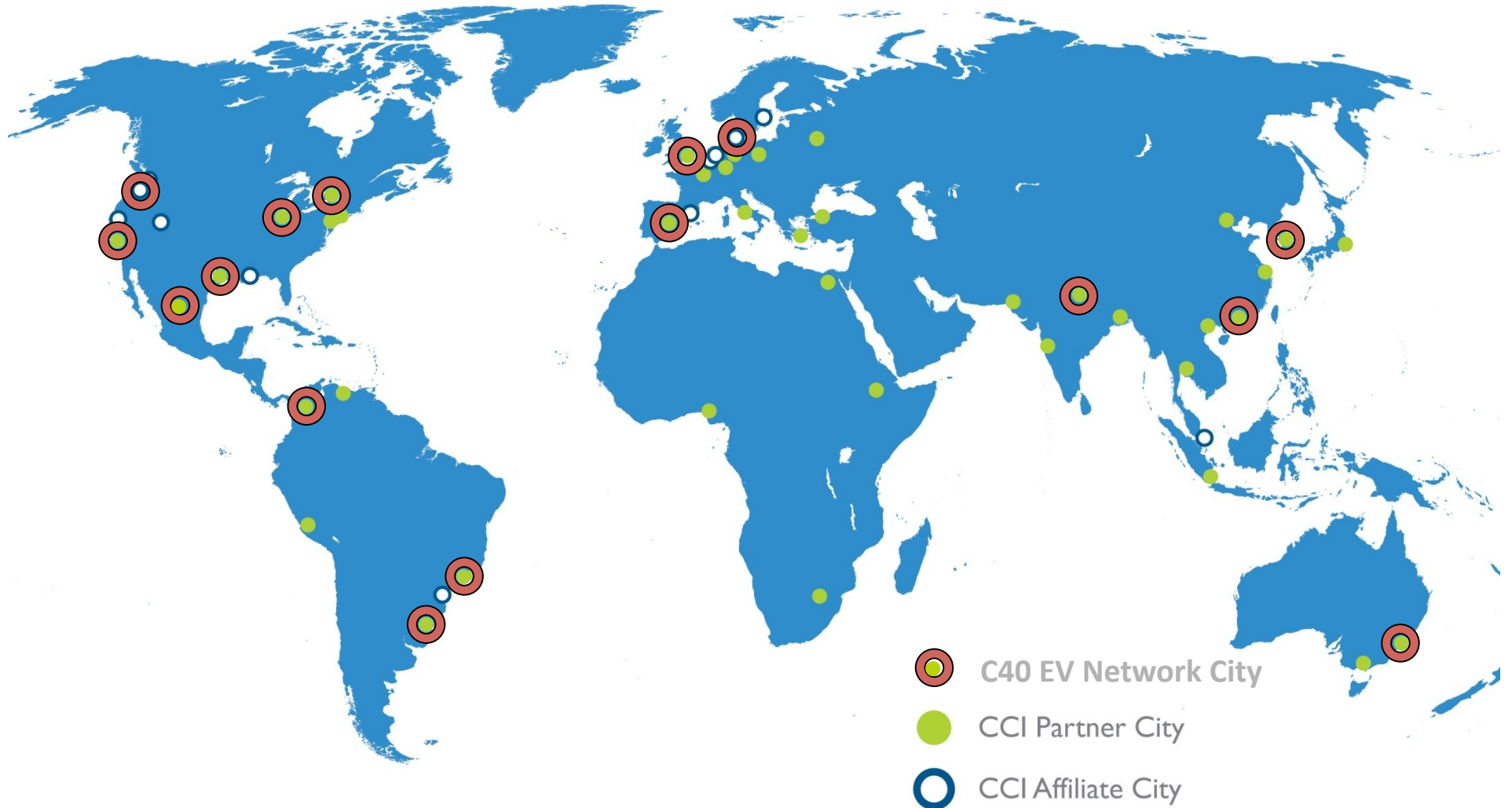


C40CITIES

CLIMATE LEADERSHIP GROUP



CLINTON
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INITIATIVE



CLINTON CLIMATE INITIATIVE OVERVIEW

CITIES

- Buildings
- Waste
- Outdoor Lighting
- Climate + Development
- Transportation

CLEAN ENERGY

- Carbon Capture and Sequestration
- Utility-Scale Solar Thermal

FORESTRY

- Measuring, Reporting, and Verification





BUSINESS



GOVERNMENT



CCI



**ENVIRONMENTAL
GROUPS**



**CLINTON
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CCI's TRANSPORTATION PROGRAM

- Our Transportation Program is focused on end-point solutions that can help the on-road transportation sector achieve carbon-neutrality
 - We don't pick technology winners but advocate in favor of smart bets
- We work primarily with the fleets that our C40 cities control or influence, and with the fleets of private-sector partners active in and around the C40 cities
- We think the case for electricity as a transportation fuel is strong and are interested in technologies that can make it a practical alternative for real-world vehicles
 - Including ammonia fuel technology



END-POINT SOLUTIONS: ONE SCENARIO

	Light-Duty (~60% of GHG emissions)	Heavy-Duty (~40% of GHG emissions)
Fuel	Electricity	Ammonia
On-Board Energy Storage	Battery	Low-pressure tank
Fuel-to-Motion Conversion	Electric motor	Internal combustion
Fuel Production	Conventional generation transitioning to renewable/ low-carbon generation	Synthesis from air, water, and electricity
Fuel Distribution	Charging stations built on top of the existing electrical grid	Pipelines and tank trucks supplying special dispensers in existing facilities

THE NH₃ FUEL AGENDA

- We believe the time is ripe for an ammonia fuel demonstration project as a step that can raise the profile of ammonia fuel amongst key constituencies
- We intend to be a catalyst for such a project in one or more of our partner cities

PROJECT ORGANIZATION

Role	Description	Candidates
Convener	<ul style="list-style-type: none"> • Develop project concept • Recruit project participants 	<ul style="list-style-type: none"> • CCI
Project Sponsor	<ul style="list-style-type: none"> • Serve as lead funder 	<ul style="list-style-type: none"> • National or state funding agency • Corporation
Project Host	<ul style="list-style-type: none"> • Provide physical base for vehicles and fueling station • Operate vehicles 	<ul style="list-style-type: none"> • Fleet proprietor associated with a C40 city
Project Manager	<ul style="list-style-type: none"> • Design and operate systems for data collection, compilation, and analysis 	<ul style="list-style-type: none"> • Technical institute
Technology Provider	<ul style="list-style-type: none"> • Provide vehicle(s) and technical support 	<ul style="list-style-type: none"> • HEC

PROJECT FOCUSES

Focus Area	Proposition To Be Debunked
Economics	“It doesn’t have a future if it can’t compete with petroleum”
Emissions Profile	“It’s great that there isn’t any carbon, but won’t it produce lots of NOx?”
Safety	“To gain acceptance it needs to be <u>safer</u> than current fuels”
Implementability	“Won’t it be like hydrogen – always ten years away?”

PROJECT OUTCOMES

What to Measure

- Fuel economy
- Maintenance expense
- Lifecycle cost
- NOx NH3, HC, CO, CO2, and PM10 emissions
- Incidence of accidental NH3 releases
- Incidence of mechanical failures

Whom to Influence

- Federal Government
 - DOE, EPA, USDA
- Safety establishment
 - SAE, NHTSA, ASTM
- Analogous players in other economic zones



GET IN TOUCH

- Your thoughts and advice – and participation – are welcome!

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