

THE HYDROLLEY: A **GREEN MANUFACTURING** OPPORTUNITY FOR NC

8th ANNUAL SUSTAINABLE ENERGY CONFERENCE

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by Stan Thompson

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Mooreville/South Iredell Chamber of Commerce

Mooreville, North Carolina, USA

The “hydrolley” (HYDRogen trOLLEY) does not exist, but it soon will. NC can build and sell them.

The first description of a hydrolley appeared in a presentation by Jean–Paul Moskowitz of France’s ALSTOM company at the Second International Hydrail Conference (2006: Herning, Denmark).

The battery-dominant configuration discussed here was explained to me in 2007 by Dale Hill, founder of the US transit vehicle firm, Proterra Inc. of Golden Colorado and Greenville, SC.

The White House Blog

Editor's Note: This was originally posted on the Department of Transportation's [blog](#).

Winning the Future, Proterra Style

Posted by Secretary Ray LaHood on January 28, 2011 at 01:38 PM EDT

When the President said that America's small businesses need to out-innovate, out-educate, and out-build their competition, he must have had Proterra in mind.

Yesterday, Federal Transit Administrator Peter Rogoff and I [toured](#) the Greenville, South Carolina, bus manufacturing plant of Proterra, Inc. And I don't think you could find a better demonstration of the American innovation President Obama invoked in his State of the Union address Tuesday night.



Why hydrolleys are the “low–hanging fruit” of hydrail:

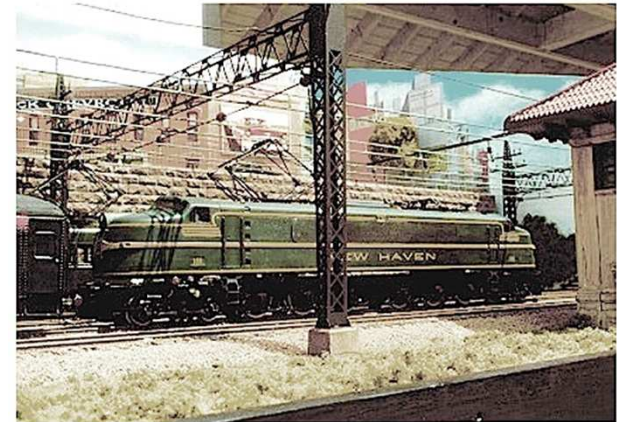
- Hydrogen FC buses are already widely deployed.
- The same power system can propel a steel–wheel version with only 1/5 to 1/7 the energy.
- Compared to the hydrolley, propelling an H₂ bus is like riding a bicycle with a flat tire.
- The full cost of tram catenaries in the US was approaching US\$ 7 million per mile of track in 2007; may be *US\$ 9 million or more per mile* by now.



Proterra LLC bus photo
“morphed” by me into a concept
hydrolley.

Europe's "Catenary Rebellion"

- **Bordeaux, France**, has the first partially wireless streetcar (by ALSTOM).
- Siemens, Bombardier/DE, Kawasaki Heavy Industries and Shanghai Transit have announced new wireless vehicles.
- Over several decades, cities have spent heavily to bury unsightly aerial utility plant; only trolley wires remain.
- The public is beginning to notice.



ALSTOM (France)



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Bordeaux: Moving unobtrusively without disturbing urban space



Commercial service : December 2003

BOMBARDIER (Germany)

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EnerGplan Simulation Tool

AeroEfficient Optimized Train Shaping

EBI Drive 50 Driver Assistance System

MITRAC Energy Saver

> **PRIMOVE Catenary-Free Operation**



PRIMOVE Catenary-Free Technology

SHANGHAI TRANSIT (China)

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Wireless streetcars to go into use in June

(02/24/2005)



Wireless streetcars to go into use in June

The city will introduce new electric streetcars that don't run along traction lines, in order to clear up the number of overhead wires in downtown Shanghai.

KAWASAKI "SMIMO" (Japan)

Kawasaki Heavy Industries to unveil NiMH-powered SWIMO

By Darren Murph  posted September 7th 2006 10:25AM

It's no secret that the engineering minds of the world are developing **new ways** to get you (and all your **co-workers**) around without making a pit stop at the fuel station. Joining the growing list of battery-powered **cars**, **supercars**, and even **scooters**, the SWIMO streetcar is set to make mass transit a greener endeavor. Kawasaki Heavy Industries (KHI) is making the wires most typically associated with trolley cars a non-issue with its "giga cell-powered" SWIMO. Rather than relying on fancy fuel cells, the juice is delivered from those tried and true nickel metal hydride batteries we've been using for years in less demanding applications. While you won't be



SIEMENS (Germany)



**Phone Conference for the Press
Fiscal Year 2009 – third quarter**

**Peter Löscher
President and CEO of Siemens AG**

Innovations in high end markets

On the revenue side, we are in an excellent position as a result of our innovation strength in high end markets. In this regard, three examples from our Sectors:

The first example is from our Industry Sector. It's the world's first streetcar with an energy storage, making operation without an overhead wire possible. This type of streetcar with hybrid energy storage can travel 2.5 kilometers without an overhead contact wire. Because they store

KINKI SHARYO (US, Japan)



At Present, Kinki Sharyo
May not offers wireless streetcars.
However, it would be well worth inquiring
as to whether they would undertake
development if the FTA Office of Mobility
Innovation offered to fund the R&D ... *with
Charlotte's encouragement!*

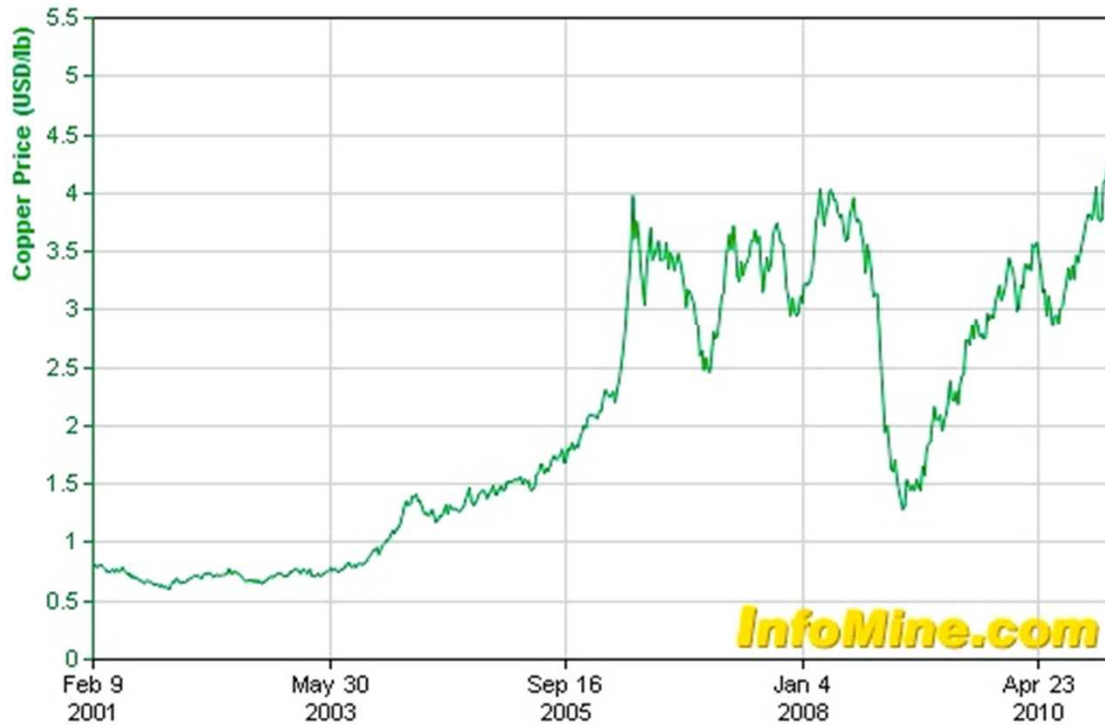
LFX-300

100% Low-Floor Hybrid Streetcar
Powered by Li-ion Battery



The catenary cost trend is unsustainable...

COPPER PRICE
Feb 9, 2001 - Feb 4, 2011



EVEN THIS EARLY IN THE RECOVERY COPPER IS AT A RECORD HIGH AND RISING FAST.

**\$ 1.75 million
/ mile**

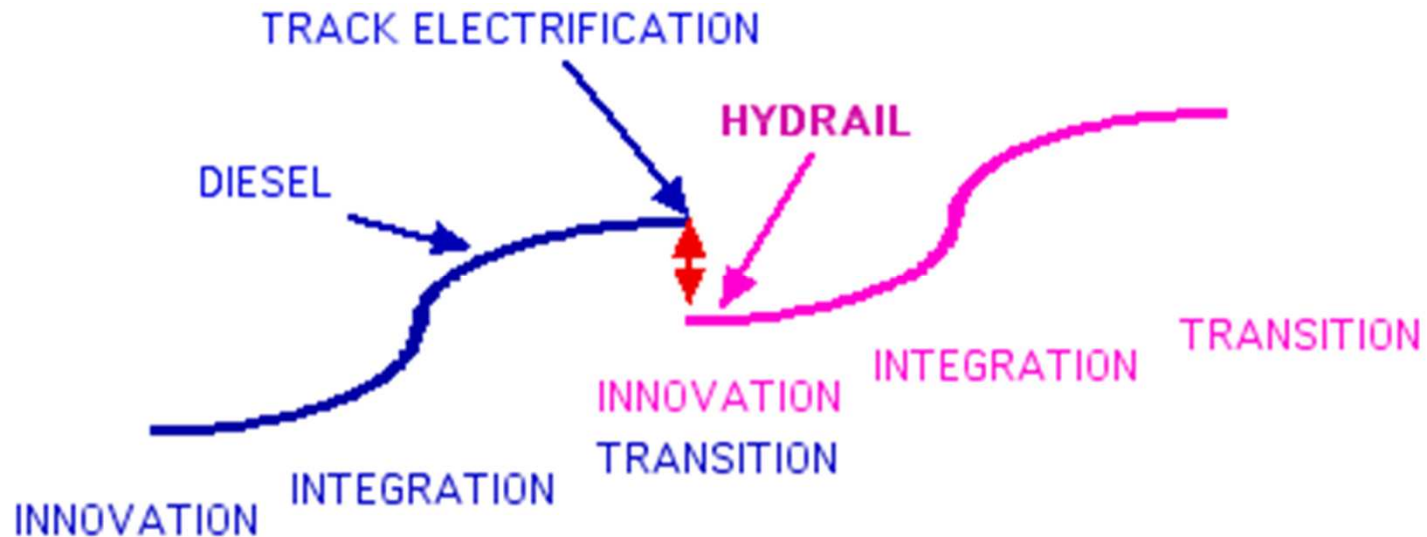
**\$ 7 million
/ mile**

**\$ 10 million
/ mile + ???**

Why the Europe's wireless trams are *not* hydroleys:

- The first wireless systems are in cities where **trams have been in place for a long time.**
- There is a huge embedded investment in rolling stock that **can be modified** to intermittent-charging technology at much lower cost than purchasing new cars.
- It's in manufacturers' and users' interest to **“milk” embedded trolley investment** as long as possible.

THE NATURE OF TECHNOLOGY CHANGE: TRANSITION IS A DANGEROUS, AMBIGUOUS TIME.



BUT AT SOME POINT, THE RISK OF HESITATING IS
ACTUALLY ***GREATER*** THAN THE RISK OF
INNOVATING—THOUGH IT MAY ***SEEM*** LESS SCARY₁₄

WHAT' S DRIVING THE STREETCAR RENAISSANCE ?

- Our cars now “own” us: purchase, maintenance, finance, parking, fuel, insurance, our personal time.
- Personal car civil disadvantages: A/Q legislation; CO₂ climate change, growing traffic.
- Urban sprawl costs for road and utility infrastructure / capital / maintenance; commuting fuel.
- A young, growing, urban-preferring demographic sees a new and different paradigm: the car as an *encumbrance* rather than the enabler of personal freedom.
- Unavoidable tension: petroleum-powered cars versus the environment.

Seattle, Portland, Salem, San Francisco, LA, San Diego, Tucson, Phoenix, Albuquerque, Denver, Colorado Springs, Spokane, Boise, Salt Lake, Sacramento, Austin, Houston, Corpus Christi, Kansas City, St. Louis, Des Moines, Minneapolis, Kenosha, Madison, Omaha, Chicago, Little Rock, Memphis, Dayton, Toledo, Cincinnati, Columbus, Lancaster, Philadelphia, Newark, Providence, Kinston NY, DC, Richmond, Roanoke, Atlanta, Savannah, Birmingham, Miami, Tampa, Grand Rapids, Boston, Lowell, French Lick Indiana, Charlotte, NC.

EXISTING AND PLANNED (a/o 2006) STREETCAR SYSTEMS = 81+



COURTESY,
JIM GRAEBNER,
APTA TROLLEY
SUBCOMMITTEE.

San Francisco, New Orleans, Philadelphia, Newark, Cleveland, Boston, San Diego, Pittsburgh, San Jose, Sacramento, Portland, LA, Houston, Denver, Salt Lake City, Buffalo, St. Louis, Galveston, Tucson, Seattle, Dallas, Little Rock, Memphis, Tampa, Baltimore, Lowell, Minneapolis, Kenosha

THE NATIONAL IMPACT

(in *very* rough numbers)

- ROUNDING OFF THE PREVIOUS APTA FORCAST, SAY **50 NEW US STREETCAR ALIGNMENTS** ARE IN THE WORKS.
- IN **2007** NUMBERS (**BEFORE** THE PRICE OF COPPER QUADRUPLED), THE COST PER MILE OF LIGHT RAIL TRACK ELECTRIFICATION WAS ABOUT **\$7 MILLION PER MILE** OF TRACK.
- ASSUME THE **50** NEW STREETCAR SYSTEMS AVERAGED **7** MILES EACH.
- **50** NEW SYSTEMS X **7** MILES X **\$7 MILLION** = **\$2.5 BILLION** NOW PLANNED FOR TRACK ELECTRIFICATION.
- IF **1%** WERE DEVOTED TO HYDROLLEY DEVELOPMENT, THAT WOULD BE ABOUT **\$25 MILLION**. THAT'S PROBABLY **FIVE TIMES** THE REAL COST.

THE HYDROLLEY vs. THE TROLLEY (TRAM)

- *No* **overhead catenary**: all municipal utility plant is buried out of sight. Onboard fuel cells plus batteries eliminate the need:
- *no* **aerial “utility” plant** (poles, guys, etc.)
- *no* transformer **substations**
- *no* **corrosion** of buried utility plant
- *no* catenary **maintenance labor**
- but: a trackside **fueling site** is now needed.

HYDROLLEY ADVANTAGES:

- Avoids **about \$7 million+** capital investment *per mile* by eliminating track electrification.
- Avoids visual pollution (poles, wires)
- Avoids obstruction problems when moving tall equipment through cities.
- Eliminates the maintenance costs, shock hazards, weather, and **damage vulnerability** of overhead power systems.

KEY ADVANTAGE: *MORE* STREETCAR LINES *SOONER*:

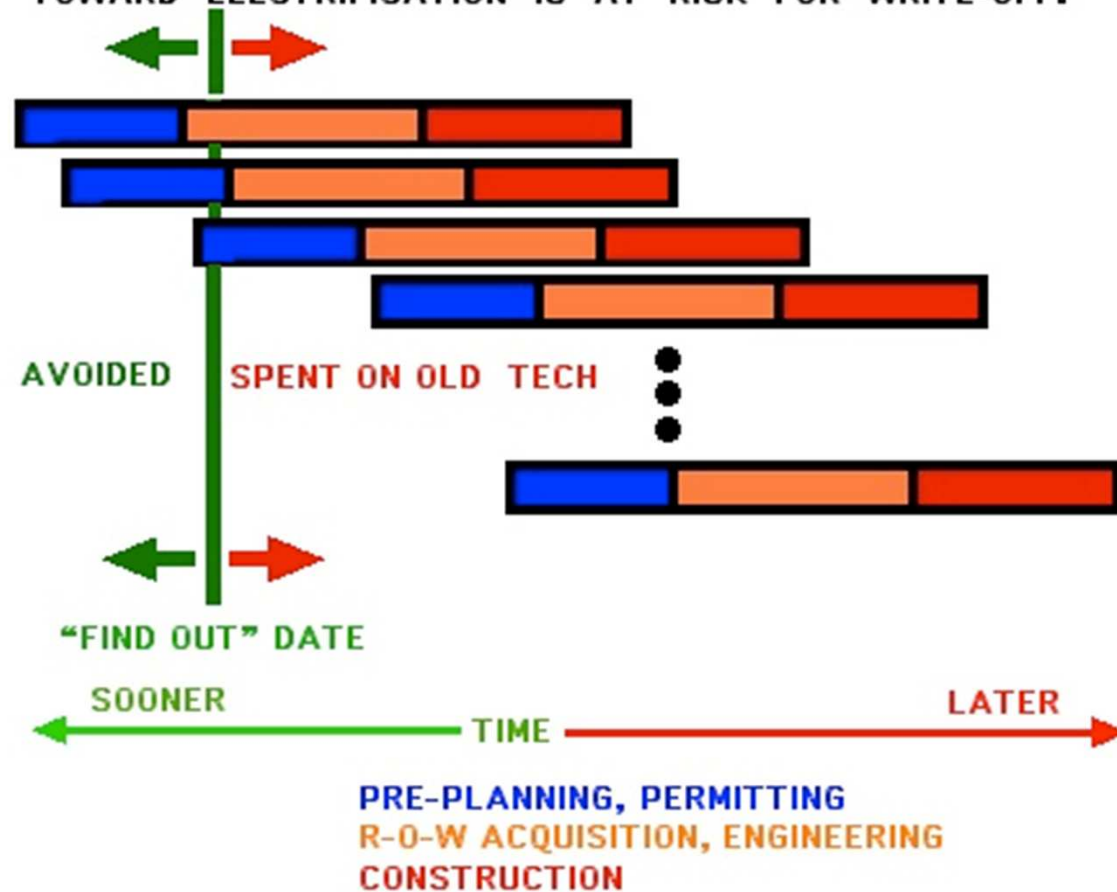
- “Lowers the bar” of capital funding by greatly reducing **fixed** plant cost.
- Clean, hi-tech image should attract ridership by young, Green-minded market segment.
- **If cities** now planning streetcar systems **collaborate to plan**, hydroly R&D and manufacturing can proceed rapidly since pricing **scale economies** will be obtained.

HISTORY FAVORS RISK ACCEPTANCE:

- Like rail's steam-to-diesel transition, **change leaves the final "old tech" investments stranded** (catenary plant and rail cars); unamortized; retired **many years** before it's worn out.
- To avoid this, what's needed is **public discussion** opening the way to hydroley acceptance, introduction plans and policies.

THE COST OF NOT KNOWING

THE LATER TRANSIT OPERATORS BECOME AWARE OF THE HYDROLLEY TRANSITION, THE MORE PLANNING EXPENSE TOWARD ELECTRIFICATION IS AT RISK FOR WRITE-OFF.



“It seemed like a good idea
at the time....”



Evening Star Standard 9F heavy freight engine, built 1960

- The last mainline steam engine built in Britain
- Planned to work for twenty years, only used for five

National Railway Museum, York, UK
(The last “wired” streetcars will very quickly
wind up in transportation museums.)

THE ECONOMIC MANDATE:

The least economic harm comes from starting early and *minimizing the duration* of trolley-to-hydroley transition.

Transition duration can be minimized by **early sharing of heads-up hydroley information with the public**. The transit industry can't spring hydroleys on the public as a surprise.

Public awareness must precede enabling policies *and* investment, both private and public.

A top priority: **nationally, cut off investment** in overhead electrification of new lines soon! Where catenaries already exist, use them until maintenance cost and public values mandate their removal.

THE FREEZE-UP RISK OF *NOT* ACTING:

If streetcar planning authorities **halt** new trolley system construction but fear of the untested hydrolley prevents deployment, the important environmental advantages of a “streetcar renaissance” are deferred or lost.

Therefore it's in the public interest to bring proof-of-concept hydrolleys into existence as soon as possible. Charlotte or Raleigh can be the alpha site for hydrolley introduction.

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