Re: World's First Fuel Cell−Powered Train Locomotive Slated for 2008

Source: http://sci.tech−archive.net/Archive/sci.energy/2004−08/0450.html

---

From: Stephen Sprunk (*stephen_at_sprunk.org*)
Date: 08/11/04

Date: Wed, 11 Aug 2004 00:44:17 −0500

"Ian St. John" <istjohn@noemail.ca> wrote in message
news:XFfSc.21015$Mq1.990024@news20.bellglobal.com...
> Stephen Sprunk wrote:
>> "Ian St. John" <istjohn@noemail.ca> wrote in message
>> news:AobSc.13997$a65.546095@news20.bellglobal.com...
>>> Stephen Sprunk wrote:
>>>> But can they actually build long−distance FC locos with sufficient
>>>> (and safe) storage capacity to match the range a full−size
>>>> diesel−electric loco can do today?
>>>
>>> No. But then we are talking about hybrids not all electric storage.
>>> Is this something like dyslexia, where you cannot help but confuse
>>> what is being discussed?
>>
>> You have to store an FC's fuel somewhere, and H2 (the fuel they run on
>> today) has nowhere near the storage density that diesel has.
>
> Again, you confuse the issue. The FC locomotive is not a 'hybrid'. The
> fuel
> cell project was making a yard switcher/ short haul as a first step which
> was clear from their selection of a GP−10 and 1.2 MW motor. The hybrid
> idea
> was introduced by comparison to the Green Goat (a hybrid yard switcher).

Right; as I said, I missed the transition between the FC loco (which is
still in the Subject line) and the hybrid.

> And if you had done some reading you would know that the FC swticher was
> using anhydrous ammonia in a tank car as the fuel source, which is a
> fairly
> dense storage for hydrogen and easily available since it is generally
> moved
> and delivered by freight trains. An interesting concept really. Not much
> use in cars as anhydrous ammonia is not very 'user friendly' but fine for
> trains which carry the stuff anyway.

The article states the H2 for the FC would be generated from anhydrous ammonia, not that the reformer would be on−board the train. It doesn't say the generation isn't on the train either, but one would think that'd be an important distinction for them to point out.

>>> No. You talked about banning diesels for environmental reasons. That
>>> would mean for their pollution, especially fine particulates. The
>>> turbines do not have this problem.
>>
>> So turbines have no pollution?
>
> Please take some remedial reading skills. I did not say that they did not
> have pollution. I guarantee that they spew out CO2 and that is becoming a
> pollutant these days, not to mention NOx, and any sulfur in the fuel is
> bound to come out as SOx. The main advantage is no fine particulates or
> organic vapors as they are very thorough at burning the fuel completely.

If one were to ban diesel, it would be for _all_ the various types of pollution it causes, not just particulate matter. And, as I noted elsewhere, modern freight locos don't emit much in the way of particulate matter anyways. The main problems are NOx and SOx.

>>>> Diesel ICEs are the most cost−effective powerplant for locos today;
>>>
>>> Not necessarily. For high output, the turbine would be the choice as
>>> it is for high speed rail. Diesels are just the traditional choice.
>>
>> Turbines do not exist anywhere in the world of HSR. Every HSR line
>> in the world, including those in the US both built and proposed, is
>> powered by overhead electric.
>
> You have a fascinating level of 'blind spotting'. Did you poke out an eye
> or
> something?
...
> Turboliners Enter Service
>
> Monday, April 14, 2003 marked the long−awaited start of revenue service
> with
> the first of the refurbished RTL−III Turboliner trainsets.

Okay, I missed that press release; they weren't in service before last year; incidentally, they went back out of service last week and were replaced with GM P32 diesel engines. The Turboliners have a top speed of 125mph and generate a pathetic 3200hp (Acela: 12,300hp) per trainset, not to mention they're being used on tracks that are still limited to 79mph.

Amtrak's MetroLiners (electric MU) are/were in daily service on the NEC with a top speed of 135mph, and before Acela were the highest−speed passenger service available in the US for decades.

> High speed rail using gas turbines in the U.S. goes back to 1950 with the
> 'blue goose'. Think of that. Five years after WW2. I'm not sure even
> aircraft has turbines as a rule back then.

125mph is not HSR, and the Metroliner was marginal at 135mph. Acela's top speed of 150mph appears to qualify, until you notice its average speed is about half that −− 82mph −− due to the poor condition of the tracks, sharp curves, congestion junctions, etc.

>> At a price roughly double that of dino diesel. Electricity is
>> between the two in price.
>
> No. At quite competitive costs. http://www.esemag.com/0501/diesel.html
> Note that you can buy commercial biodiesel in Toronto and have it
> delivered
> by tanker truck. There are also two retail stations selling a 20% blend of
> biodiesel/diesel.

Current national average pump prices (minus taxes) are $2.23/gal for biodiesel and $1.10/gal for dino diesel. Theoretical costs of production aren't interesting.

I misspoke on the relative price of electricity; it's actually more than biodiesel (I was thinking of ethanol, which is higher). An amount of electricity equivalent to a gallon of diesel is (excluding taxes) $2.47.

>> And, while I know electricity in the US isn't pollution−free, neither
>> is biodiesel.
>
> Exactly what pollution are we talking about? Pesticides?

Most electricity in the US comes from burning coal or NG, which obviously both pollute (not to mention not being renewable). Even nuclear, which doesn't pollute the air, has a nasty problem with spent fuel rods.

>>> Think a second. The rails are electified for high speed rail. Whay
>>> would they use inefficienc onboard diesels when they already have
>>> the power freely available. Do not confuse the driving motivation
>>> with the opportunity cost.
>>
>> Europeans don't use diesel when electricity is available because
>> diesel is more expensive there.
>
> Not the point. They could still have used diesel powered locomotives.

Europe could use diesel today, but they don't because it costs more.

> The driving force for the change came with high speed passenger rail
> which COULD NOT use diesels and thus paid the 'cost of conversion' after
> which it became simple for freight to use the same electification grid.

Once you have the catenary up, diesel is still cheaper in the US than electricity. Even on Amtrak's NEC, which is completely electrified, most of the freight trains and even many passenger trains use diesel because it's cheaper. Only Acela, the Metroliners, and a few commuter trains use electric.

>> The opposite is true here: most freights running on electrified rail
>> lines still
>> use diesel because it's more cost−effective.
>
> Rather, there is only one area which has the electicity infrastructure to
> support the electrified rail system. I pointed that out to you. Having
> trouble with your reading skills again?

See below.

> I posted the link. It also notes the problems in running an overhead
> electic
> system and other notes point out that this si the ONLY area that can
> currrently electify their passenger rail system. Which explains why the
> New
> York to Detroit run is using a turbine.

No, it says that's the only area with enough catenary to power high−speed trains. Similar catenary could be installed on any other rail line in the country. The real problem is that Amtrak doesn't own much track except for the NEC, and they have no authority to force a private railroad to install catenary −− and as I've noted, the freight RRs have no motivation to do it for their own use.

>>> Hmm. It mentions the problems of carrying the 25kv catenary over
>>> lifting bridges. The engineering challenges are not trivial and I
>>> imagine that level crossing must be avoided and that must costs a
>>> LOT. Only one place has the traffic to afford this in the U.S. I
>>> guess. http://www.house.gov/mica/rlhigh.htm
>>> "In the United States, the 400−mile route between Washington, DC and
>>> Boston (the Northeast Corridor) is virtually the only track with
>>> enough overhead electric lines to supply electricity to a high−speed
>>> rail train."
>>> which is why, I imagine, that the majority of proposals have been for
>>> turbine powered locomotion.
>>
>> No, the other proposals have all included similar electrification.
>
> No. Proposals for Florida, California, etc tend to be 'show me' at this
> point and include things like mag lev or overhead suspension. Not to be
> taken as serious commitments yet. As noted, there isn't the electicity
> infrastructure for it yet and that would be a major cost.

The HSR proposal in Florida (FOX) was for a TGV derivative, using electric power. Ditto for Texas. No other proposals have gotten to the funding or

planning stages (except, of course, for Acela on the NEC).

If you want to count projects proposed by crackpots with a vested interest in other technologies, like maglev, yes there have been proposals −− but none that have attracted the attention of anyone with the money to actually make it happen.

>> As does every existing HSR line in the world −− France, Germany,
>> Spain, Japan, etc. all use overhead electric, not turbines.
>
> I am not pushing turbines. I have just noted that the U.S. tends to
> propose
> them as the only way to make a high speed rail service without the
> development of the electical infrastructure.

The world record for a turbine train is 378km/h; none is in service faster than 200km/h. The world record for an electric train (actually, all trains) is 515km/h, and they'll soon be raising the operating speed from 300km/h to 320km/h in France.

HSR competes with air, which moves at 800km/h but has about an hour and a half of passenger delay, so 200km/h rail is only competitive up to about 400km (250mi). 320km/h rail would be competitive out to 800km (500mi). That's twice the distance.

Also, the TurboLiner doesn't meet FRA regulations for new production, so after you refurb the few that are left you'd need 5−10 years of development to get one out the door, and if it's to be certified for 125mph operation _now_ it'd have to be two to three times the weight per passenger of the older trains. That means a lot more fuel consumption, even longer acceleration, etc. These rules are the main reason Acela is such a dog compared to TGV, even though it's built by the same people.

>>>> Weight is actually an advantage for freight; electric locos actually
>>>> require ballast weight to improve traction. Nobody but you brought
>>>> up passenger rail.
>>>
>>> Actually, you did with your referecne to high speed passenger trains
>>> in Europe using electricity.
>>
>> No, I started by talking about "Most long−distance freight in Europe
>> is electric"; you mentioned passenger rail first.
>
> Well, that is splittting hairs. The electrifictions of rails in Europe was
> primarily driven by the need for high power, low weigth for passenger
> travel
> so it immediately comes to mind when discussing electrically powered
> trains
> in Europe which YOU brought up.

The European railways were electrified long before TGV showed up in 1981.

S

−−
Stephen Sprunk "Those people who think they know everything
CCIE #3723 are a great annoyance to those of us who do."
K5SSS −−Isaac Asimov