



Ultra-Low Emissions “Genset” Switchers

**CARB hearing
Sacramento, CA ~ July 13, 2006**

Lack of new-technology switchers

→ February 2002

- ✦ UP started discussions with National Railway Equipment about use of truck-derivative diesel engines to produce a new generation of low-emissions, high-fuel-efficiency yard switchers

→ June 2004

- ✦ UP senior management approved funding for prototype “genset” switcher from NRE

→ December 2005

- ✦ Prototype “genset” switcher delivered

→ August 2006

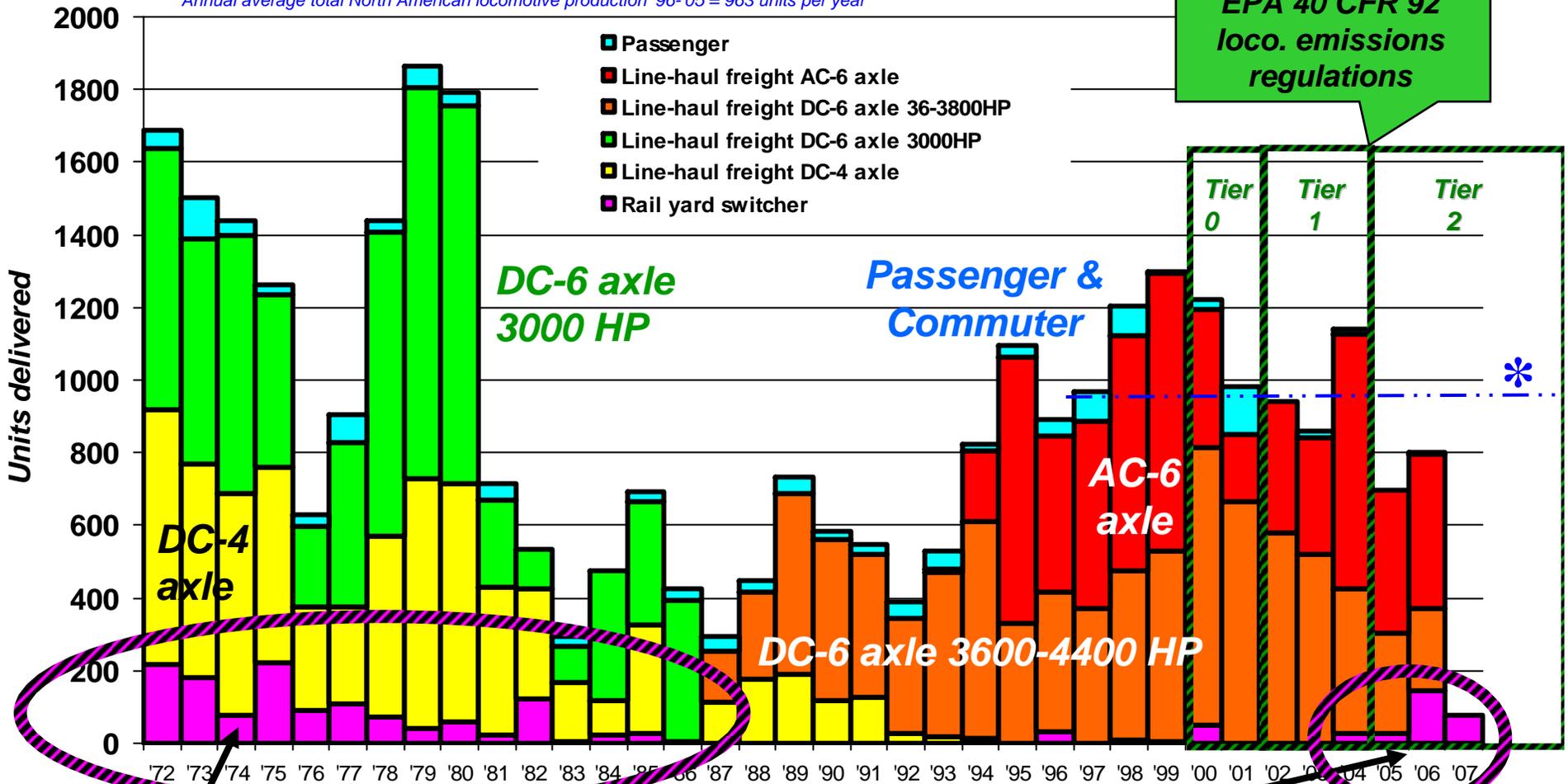
- ✦ First of (60) “gensets” for LA to arrive



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The "new" rail yard switcher market

NOTE: Chart is based on estimated deliveries, data obtained from numerous public sources.
 * Annual average total North American locomotive production '96-'05 = 963 units per year



ex-SP 2690

Rail yard switchers

UPY 2005 gen-set prototype



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UP: *supporting a new switcher market*

→ **Conventional rail yard switchers were last made in quantity in early-1980s**

- ✦ **US RRs deregulated in 1980 ... yard operations altered**
- ✦ **Many small yards were closed, resulting in large surplus of older rail yard switching locomotives ... *no market for new switchers for 25+ years***

→ **Now 2 new suppliers in an active marketplace**

- ✦ ***Railpower, manufactures Green Goat™ hybrids (UP has 10 in TX, 11 in/ordered for CA) and gen-set switchers (UP has 98 ordered for TX)***
- ✦ ***NRE ... builder of UPY 2005 gen-set prototype ... now building 60 for UP for LA basin***

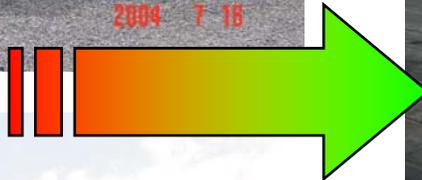


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Classic switcher v “genset”



1974-built EPA pre-Tier 0
(unregulated) 1500 HP switcher



2005-built EPA Tier 2
and CARB-certified Ultra-Low-
Emitting-Locomotive (“ULEL”)



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California rail yard applications



“Hump” locomotives push rail cars up to the crest of a hill (above), where the cars are uncoupled, rolling by gravity into proper tracks for outbound trains. UP has such facilities at Roseville and West Colton in California.

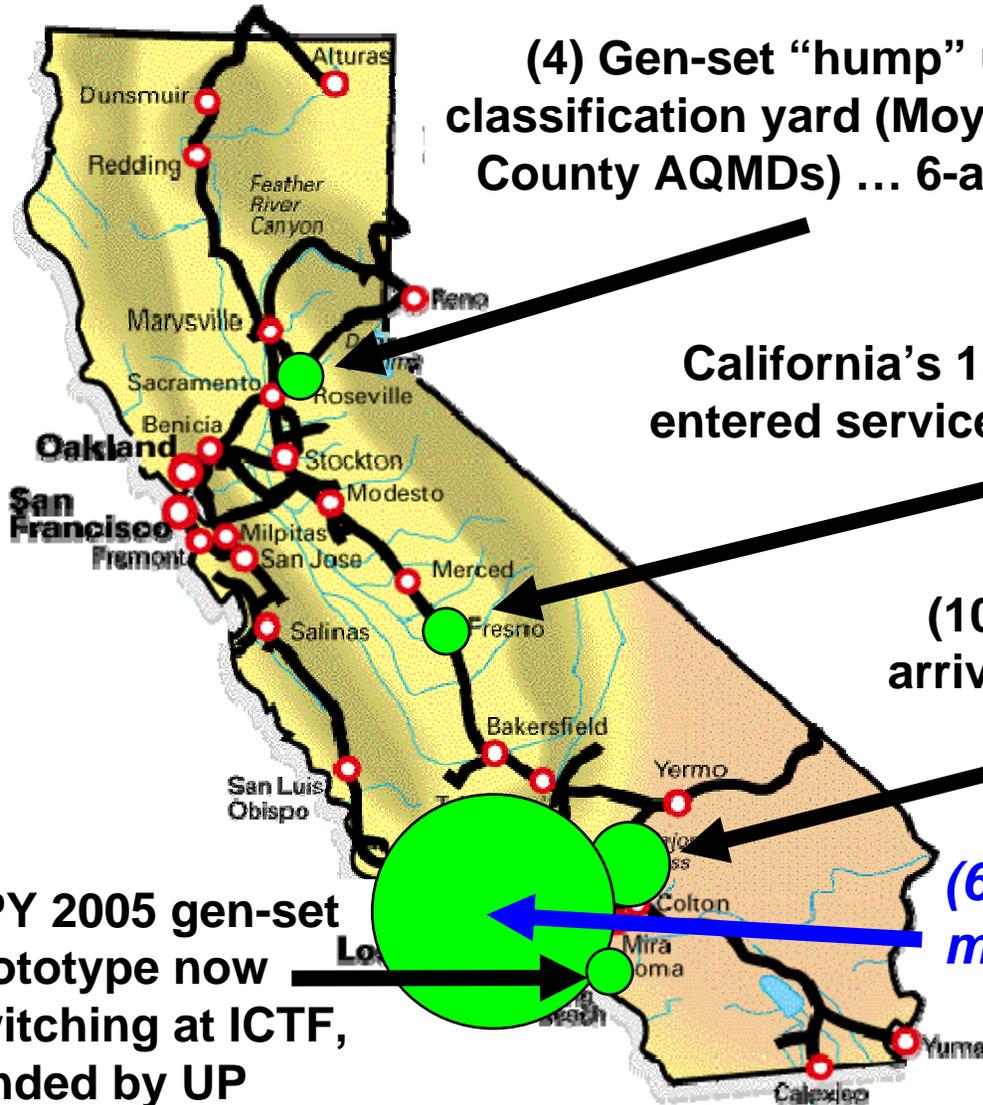


Most rail yard switching activity involves moving freight cars between trains, assembling outbound trains (left) and serving local industry tracks. UP has about 15 rail switching yards of various sizes in the Los Angeles basin.



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CA's low-emissions ULEL yard fleet



(4) Gen-set “hump” units under design for Roseville classification yard (Moyer grants thru Sacramento & Placer County AQMDs) ... 6-axle version of UPY 2005 prototype

California’s 1st diesel-battery hybrid, UPY 2004, entered service in Fresno on April 8, 2005 (Moyer grant thru SJV APCD)

(10) Railpower “Green Goat” hybrids arriving for Mira Loma and Montclair rail yards

(60) genset switchers now being manufactured for LA basin

UPY 2005 gen-set prototype now switching at ICTF, funded by UP

All are Ultra-Low Emitting Locomotives (“ULELs”)!



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Gen-Set switcher advantages

→ Quantum improvement over existing units

- ✓ Up to 80% reduction in NOx and PM, using EPA test protocol, compared to existing unregulated yard units.
- ✓ Up to a 40% reduction in diesel fuel use (“ “).
- ✓ Reduction in lineside noise due to engines.

→ Uses innovative application of EPA certified nonroad diesel engine technology matched to rail yard switching power demands



📄 EPA Tier 2 locomotive certified

📄 CARB Ultra-Low Emitting Locomotive (“ULEL”) status



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UP pioneering “genset” technology



(60) genset switchers being manufactured for UP (direct acquisition) by National Railway Equipment ... for use in LA Basin ... August 2006-thru-August 2007 delivery

Another (98) 1900 HP genset switchers being manufactured for UP (Texas TERP grant) by Railpower Technologies ... for use in Texas ... same delivery period



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Rail application of EPA Tier 3 off-road



**Cummins QSK19G 700 HP engine (3rd of 3) for
first production genset unit ... UPY 2701 ...
being mated to alternator on July 7, 2006**



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UP's LNG & Gen-Set switcher R&D

LNG: 1995

2000 HP diesel engine required to obtain 1200 HP using LNG fuel



UP operated two (2) LNG-fueled 1200 HP switchers at Commerce Yard, 1995-1998. The locomotives were built pre-EPA loco. emissions regulations and test protocol, but LNG emissions data was gathered.



Two 700 HP EPA Tier 3 nonroad diesel Gen-Sets for 1400 HP

Diesel Gen-Set: 2005

Gen-Set prototype UPY 2005 is being operated under similar conditions. Emissions data was gathered (and certified) under EPA locomotive Tier 2 protocol.



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Diesel “Gen-Set” compared to LNG

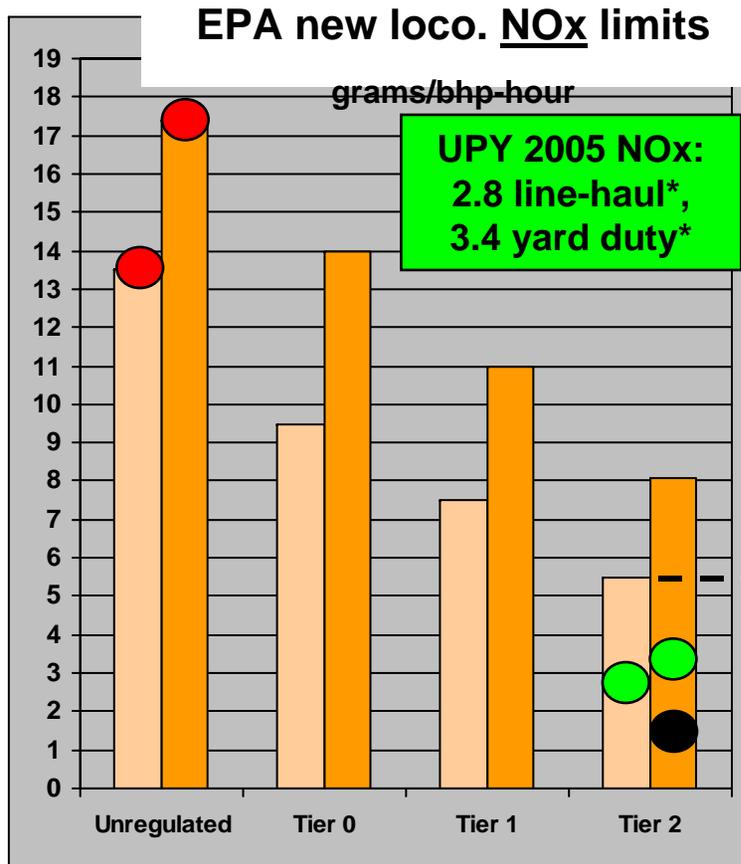
- Best available LNG switcher emissions data is from MK Locomotive MK1200G LNG switcher test data from 1993, adjusted to EPA protocol*.
- UPY 2005 has been tested in accordance with, and certified under, U.S. EPA Tier 2 locomotive emissions regulation**.
- In EPA yard duty mode (grams/brake hp-hour):

	NOx	PM	CO	Unburnt HC (NMHC for LNG)
 MK1200G LNG*	1.4	0.09	2.2	3.3
 Gen-Set diesel**	3.4	0.06	1.51	0.036



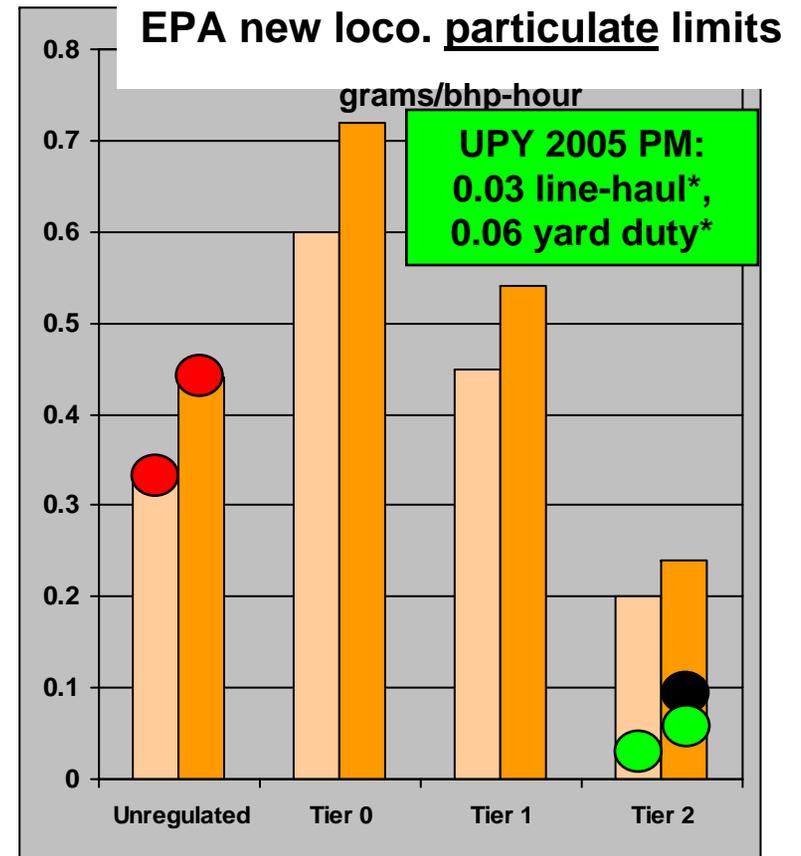
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Gen-Set v LNG switcher emissions



pre-Tier 0 <2000 Tier 0 '00-'01 Tier 1 '02-'04 Tier 2 '05+

- SP 2690 emissions (built 1974)
- Gen-Set UPY 2005 EPA certification
- LNG switcher



pre-Tier 0 <2000 Tier 0 '00-'01 Tier 1 '02-'04 Tier 2 '05+

* Based on EPA Part 92 locomotive emissions regulations and test protocol.

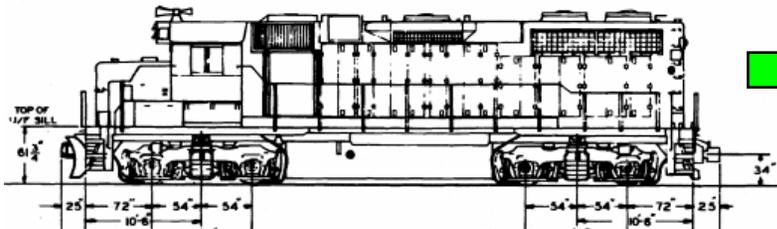
** EPA cert. testing fuel is higher in Sulfur content than CARB fuel.



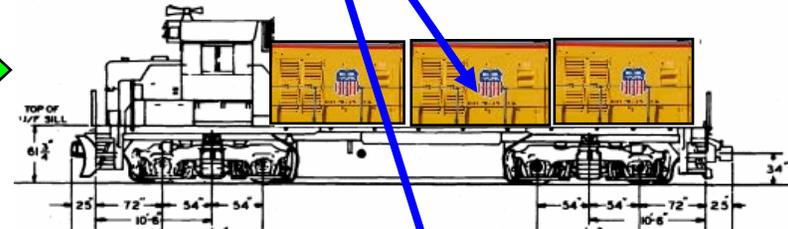
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Modular rail yard switchers

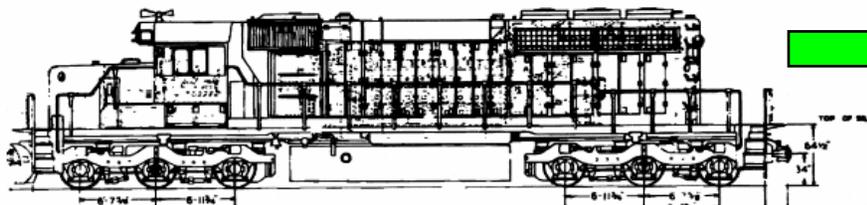
1400 HP gen-set prototype unit UPY 2005 (*) ...
 (2) 700 HP Tier 3 nonroad gensets in modular packages



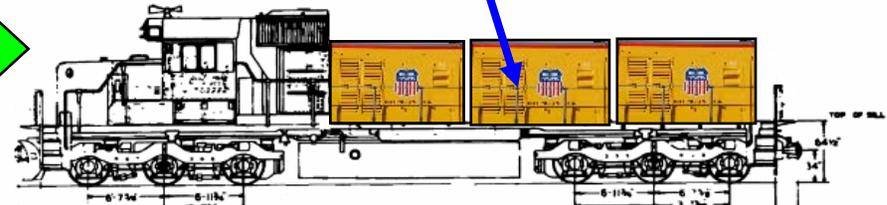
2000 HP EMD GP38-2 Los Angeles switcher with (1) large diesel engine on 4-motors



2100 HP genset Los Angeles switcher with (3) 700 HP gen-sets on 4-motors (**)



2000 HP EMD GP38-2 Roseville hump unit with (1) large diesel engine on 6-motors



2100 HP genset Roseville hump unit with (3) 700 HP gen-sets on 6-motors (***)

(*) UP funded construction of the gen-set prototype UPY 2005.

(**) UP is reviewing bids to acquire (60) of these units for service in the Los Angeles area.

(***) Sacramento and Placer County AQMDs have filed for a Moyer program grant to assist UP in building this prototype locomotive.



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UP's T2 low-emissions yard fleet: *US*

Roseville: (4) NRE gen-set hump units being designed *[Moyer]*

Fresno: (1) Railpower Green Goat hybrid in-service *[Moyer]*

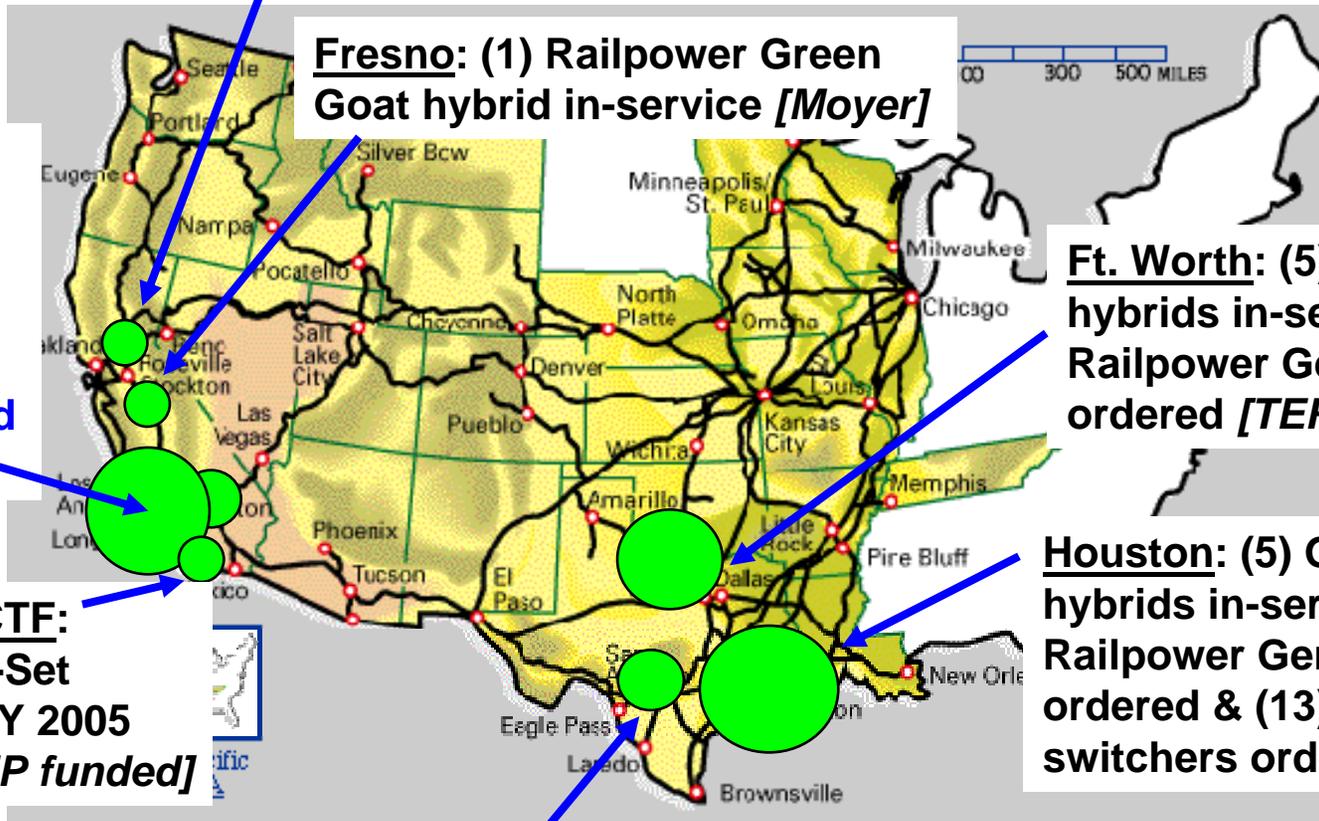
LA basin yards: (60) Gen-Set switchers being manufactured for UP

Commerce/ICTF: (1) NRE Gen-Set prototype UPY 2005 in-service *[UP funded]*

Ft. Worth: (5) Green Goat hybrids in-service & (46) Railpower Gen-Sets ordered *[TERP]*

Houston: (5) Green Goat hybrids in-service, (43) Railpower Gen-Sets ordered & (13) Cat switchers ordered *[TERP]*

San Antonio: (9) Railpower Gen-Sets ordered *[TERP]*



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