West Coast Collaborative - Can We Have It All?

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Lanny A. Schmid

Minimize Emissions, Reduce Petroleum Consumption or Ensure Technical Feasibility- Can We Have It All?

What are various market mechanisms to reduce petroleum consumption while ensuring low-emission fuels and technologies? How can government programs accelerate such?

. . . basic approach to various market mechanisms (Moyer, GMERP, DERA, TERP, etc,) is the same as that used to evaluate testing and deployment of new technology . . . .

UPRR's General Approach – A Comprehensive & Aggressive Program

- Identification - look for/consider potential technologies
- Evaluation - test to objectively determine pros and cons
- Development - adapt to UPRR operational reqt's/needs
- Acquisition – obtain the equipment or technology
- Deployment - dedicate to use for continued evaluation
- Optimization – continued tweaks for maximum benefit
- AND FINALLY, Utilization – ensure full time usage and continued improved capability

Step #1 : Identification – Look For/Consider Potential Technologies

- **Existing/In Use – new/remanufactured Tier 0, 0+, 1+ and Tier 2 road/switch locomotives, ULEL Green Goat and Genset switchers, shutdown devices, repowered road locomotives w/ SCR after treatment, distributed power**
- **Prior Evaluations – shut down devices, DOC and DPF retrofits on older locomotives, scrubber for locomotive exhaust, LNG road locomotives**
- **Potential Future – road hybrids, in cylinder/engine enhancements, fuels, turbines, operational improvements, on-board energy storage (batteries, flywheels, ultra capacitors), aerodynamics, after treatment, fuel cells**

Step #2: Evaluation – Test To Objectively Determine Pros/Cons

- Safety and compliance with regulations
- Operational Considerations – parts compatibility, training requirements, consumables, maintenance, horsepower, range, tractive effort, and physical limitations (infrastructure, height, width, and length)
- Financial Aspects – fueling and track infrastructure, capital and O&M costs, cost effectiveness, equipment life span, ROIC
- Emissions Impacts – oxides of nitrogen, ROG, particulate matter, GHG's, and sulfates

Step #2: Evaluation – Test To Objectively Determine Pros/Cons

Federal Regulation of Freight Railroads

Surface Transportation Board (STB)	**Financial Standards:** Rates, Mergers, Safety, Environment
US Environmental Protection Agency (US EPA)	**Environmental Standards:** Locomotive Emissions Standards, Water Quality, Toxics & Waste Regulation
Customs and Border Protection	**Security Standards:** Transportation over Northern and Southern borders
Transportation Security Administration (TSA)	**Security Standards:** Transportation Security
Federal Railroad Administration (FRA)	**Safety Standards:** Maintenance of Track and Equipment, Grade Crossing Warning Devices, Noise (from rail operations including locomotive horns), Operations, Employee Safety
Pipelines and Hazardous Materials Safety Administration	**Safety Standards:** Transportation of Hazardous Materials
Department of Agriculture and Food Safety	**Safety Standards:** Inspections for Agricultural Pests, Inspections at the Borders
Occupational Safety and Health Administration (OSHA)	**Safety Standards:** Working Conditions in Railroad Shops

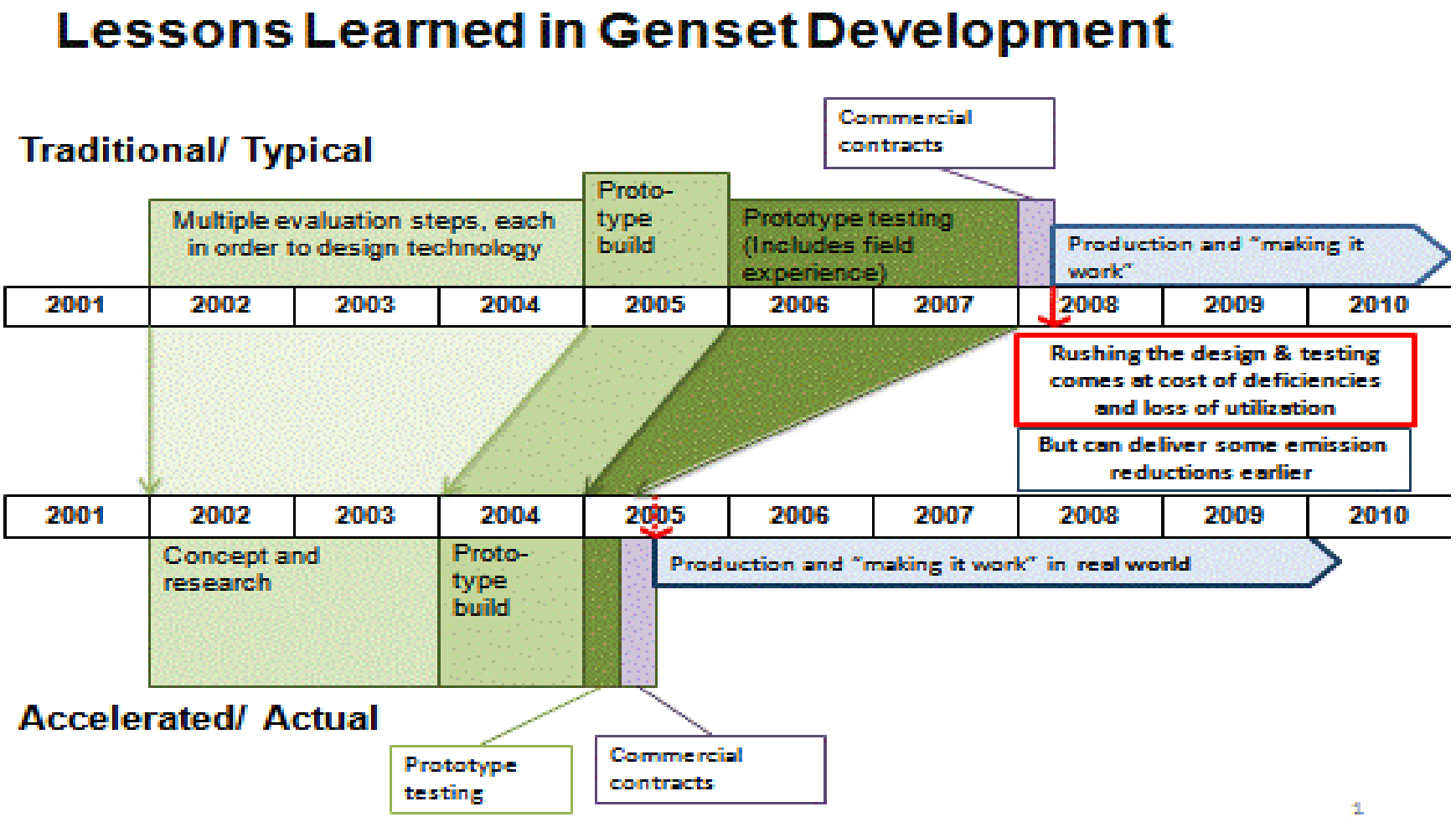
Step #3: Development – Adapt to Operational Requirements & Needs

60-Day Movement of *One Class 1 Line-haul Locomotive*

Step #4: Acquisition – Obtain the Equipment or Technology

- **Non Disclosure Agreements – utilized to protect new technology not yet patented**
- **R & D Programs – provide incentive funding for new/enhanced equipment (i.e. - GMERP, TERP, etc.)**
- **Emissions Reductions Programs – incentive funds to acquire and utilize new, lower emitting machinery (i.e. – CMP, DERA, TERP, etc.)**
- **Business Needs – capacity/growth, efficiency, enhanced technology**

Step #5: Deployment – Dedicate to Use for Continued Evaluation



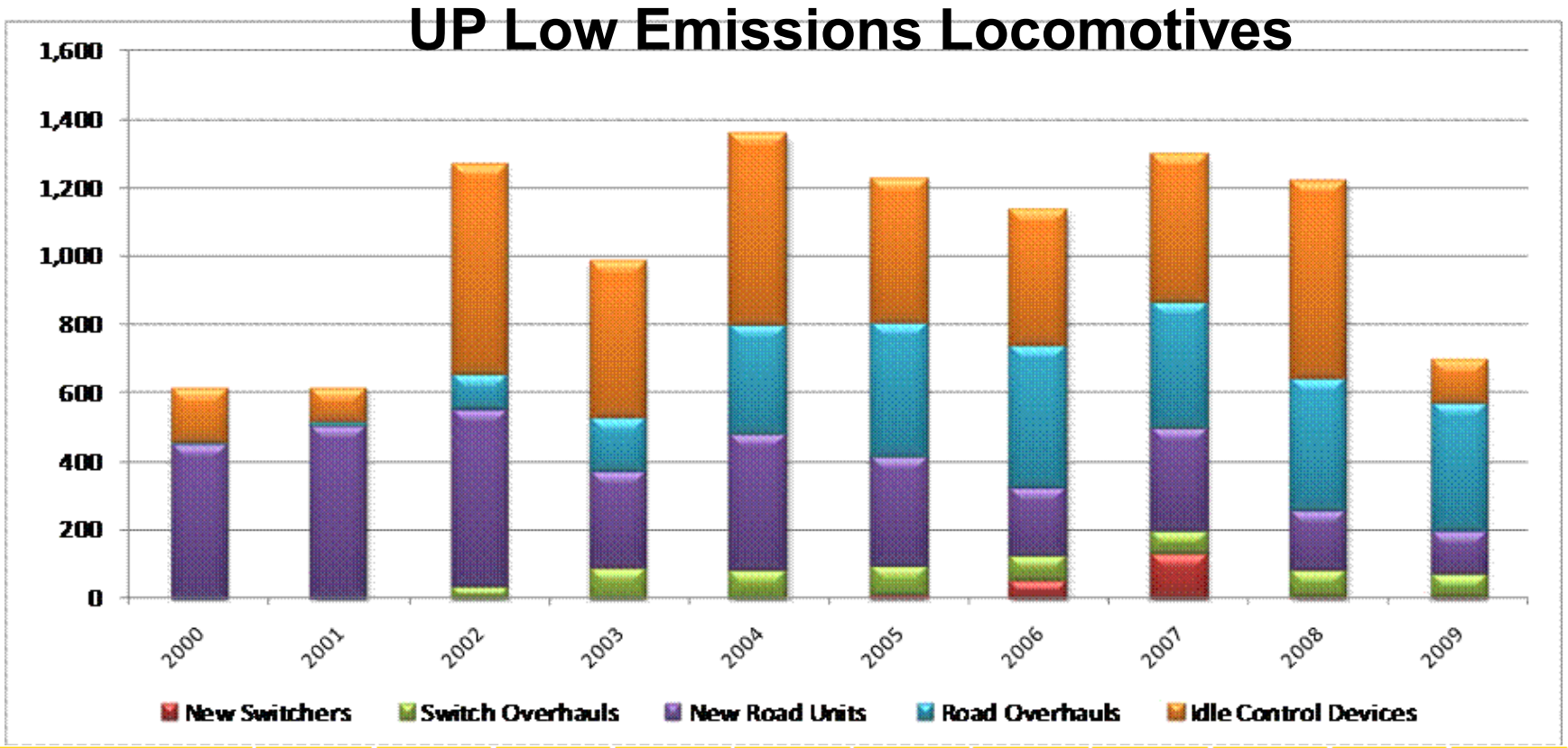
Step #6: Optimization – Continued Tweaks for Maximum Benefit

- **Safety Enhancements (i.e. - TIR's, DP controls, etc.)**
- **Remedy Deficiencies - battery fires, turbo's, electrical controls, traction motors, hardware/software for computers**
- **Train Control - distributed power, data access**
- **Emissions Benefits – potential after treatment equipment**

Step #7: Utilization – Ensure Full Time Usage & Improvements

Loco	Model Nbr	Utilized?(y/n/?)	Reported?	Latest Mech Status
UPY 2607	RP20GE	Y	Y	RW
UPY 2608	RP20GE	?	N	IS
UPY 2609	RP20GE	Y	Y	WK
UPY 2610	RP20GE	?	N	WK
UPY 2657	RP20GE	Y	Y	WK

RESULT – Excellent Knowledge of Technology & Cleanest Locomotive Fleet in North America



Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
New Switchers						11	51	130	4	2	198
Switch Overhauls			35	90	81	84	73	65	80	67	575
New Road Units	451	500	516	279	398	318	200	300	175	125	3,262
Road Overhauls	6	13	104	159	320	390	412	370	385	375	2,534
Idle Control Devices	156	98	612	459	561	422	400	434	575	127	3,844
TOTALS	613	611	1,267	987	1,360	1,225	1,136	1,299	1,219	696	10,413

Can We Have It All?
Reducing Emissions through Technology

- **Achieves (or exceeds) environmental goals**

- **Uses "real world" technology**
  - Realistic trade-offs between expectations & achievables

- **Technology & infrastructure are matched**
  - A technology is of little use if it cannot be supported (ex: fuels)

- **Meaningful balance between benefits & risks**
  - Avoiding "tyranny of the perfect"
  - Accumulating results vs. waiting for "moon shots"

Discussion