Transport Revolutions in Calgary's Future

Anthony Perl

Simon Fraser University Vancouver

aperl@sfu.ca

You need to read:

TRANSPORT REVOLUTIONS

MOVING PEOPLE AND FREIGHT WITHOUT OIL

Richard Gilbert and Anthony Perl

Outline

1. Why **oil depletion** is a likely trigger of transportation policy innovation that will also address climate change impacts.
2. What **transport revolutions** can be expected to occur as a result of oil depletion.
3. **Key goals** for a policy framework that anticipates oil depletion and facilitates sustainable mobility for Calgary's future.

Oil Depletion: The Other Side of the Peak

Liquid petroleum fuels, power 95% of today's transportation.

They are refined from:

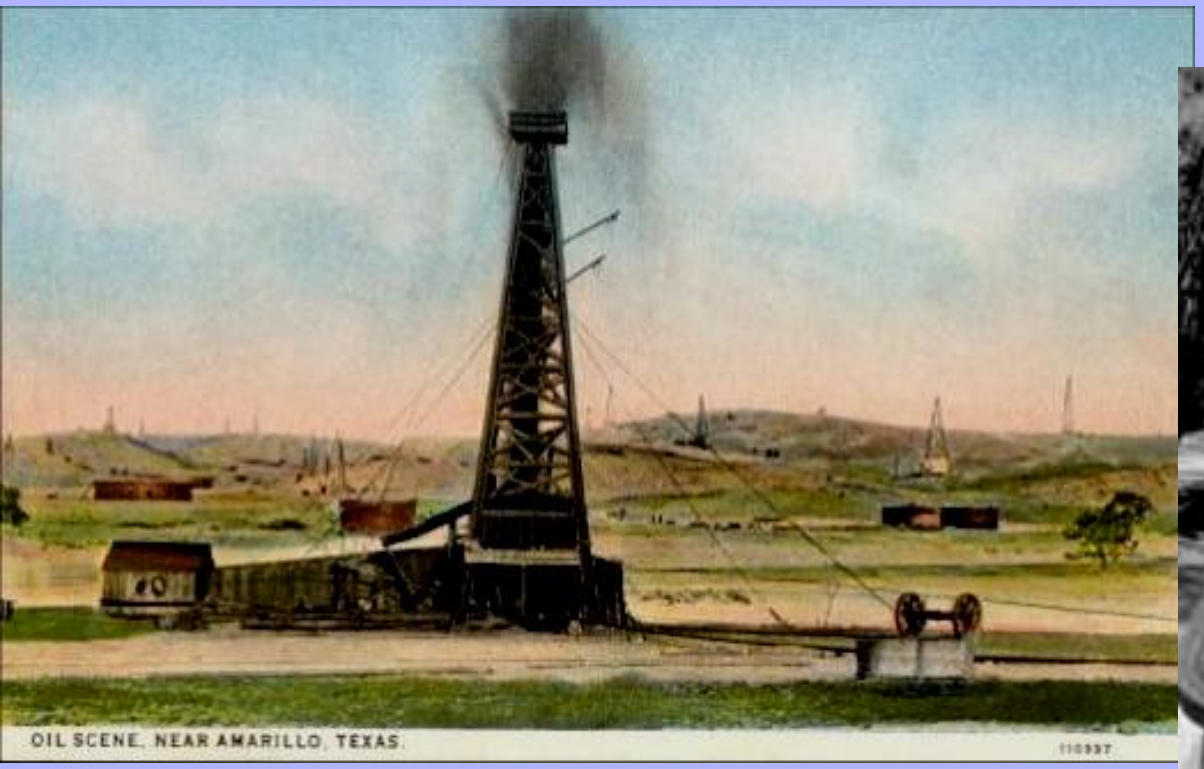
Conventional oil (relatively accessible wells)

Unconventional oil (oil shale, tar sands)

Natural gas liquids (e.g., propane, butane)

TOTAL OUTPUT CANNOT BE COUNTED ON TO KEEP GROWING PAST 2012

Conventional oil: past its peak



Fuelled the 20th Century American Dream

Unconventional oil: No panacea

Costs a lot more $ and energy to extract and refine, unlikely to keep up with conventional oil depletion; GHG intensive

Natural gas liquids: Hidden helper

A by-product of gas production and a supplement to crude oil refining; taking up slack for now

Oil Depletion Dynamics

World conventional oil production is 80% or more of total petroleum liquids (depending how defined); it likely peaked in 2006.

World unconventional oil production is growing slowly, now 5-10% of total, rising to 15% by 2050. More than tripling this output is unrealistic.

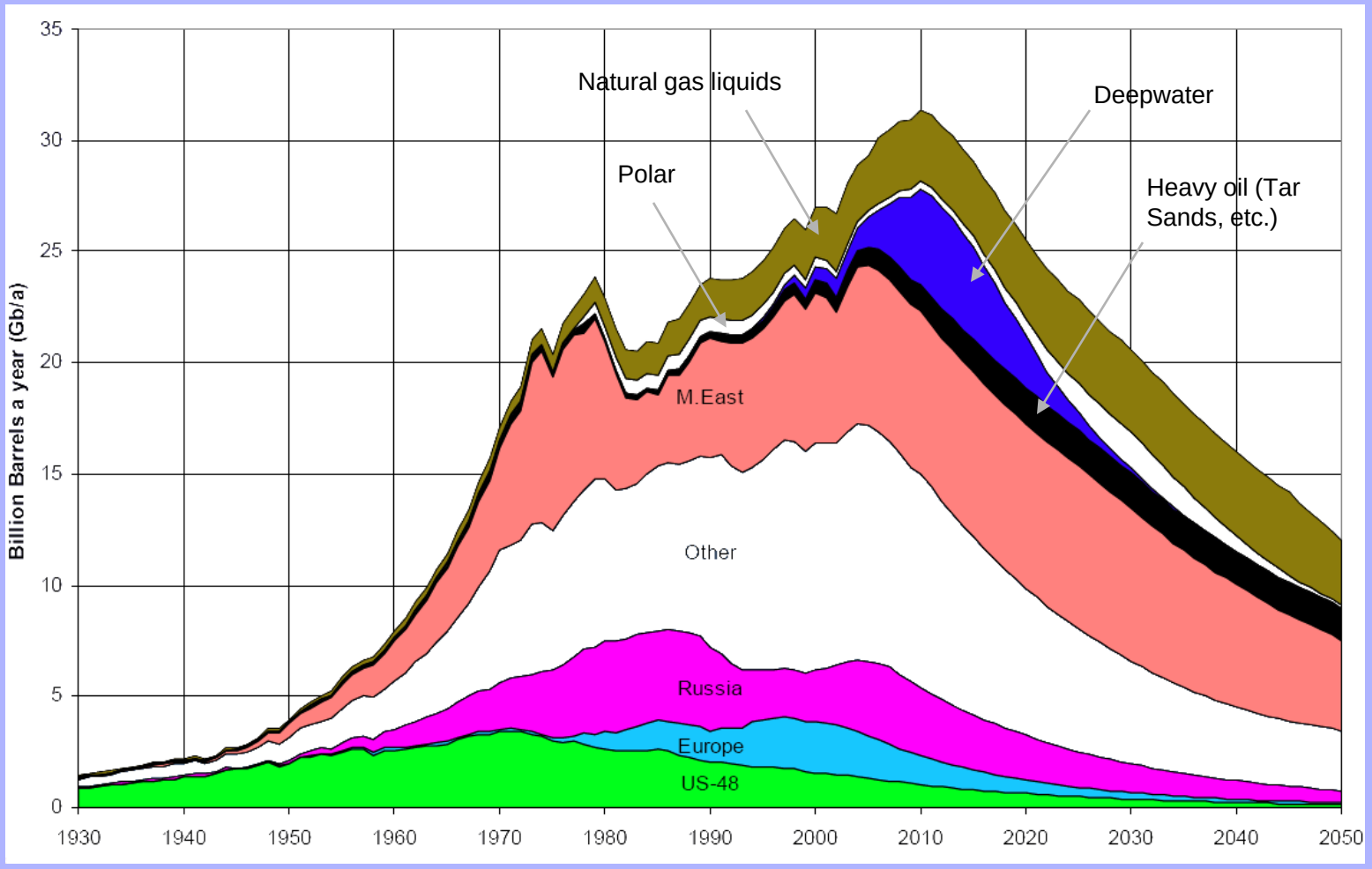
World natural gas liquids production is growing slowly, now 10-15%, rising to 25% by 2050.

Global Oil Depletion's Timing is More Controversial Than Its Existence

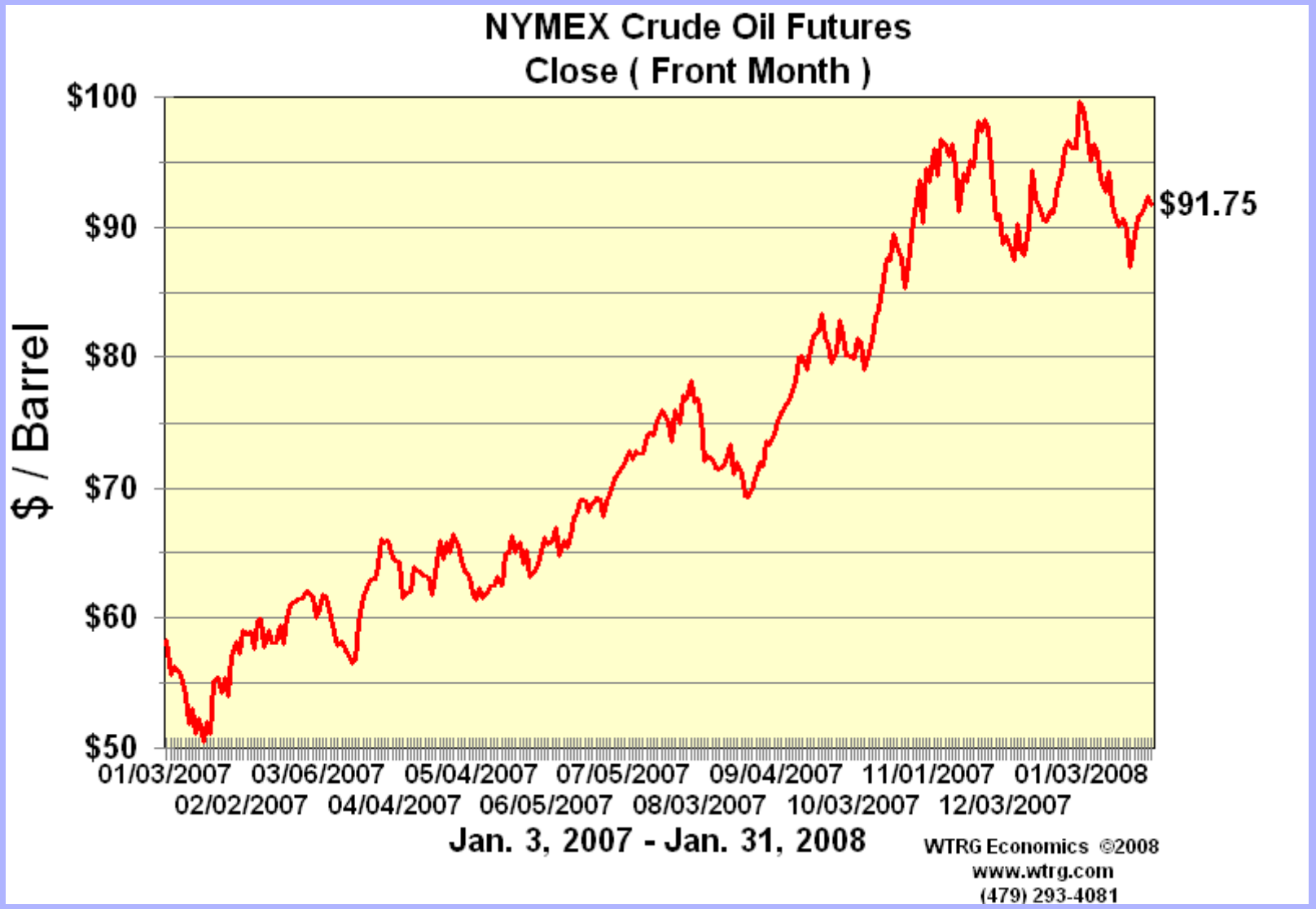
- IEA assumes its demand projections can be met by sufficient supply, so do BP and Cambridge Energy Research Assoc. (US).
- But, IEA has also said, "Despite four years of high oil prices, this report* sees increasing market tightness beyond 2010, with OPEC spare capacity declining to minimal levels by 2012".*
- By contrast, the CEOs of Total and ConocoPhillips and the chair of Libya's national oil company have said world supply will peak well before it reaches levels required by IEA's demand projections.
- James R. Schlesinger, the first US Secretary for Energy, and also Secretary for Defense and head of the CIA, said in Ireland in September, "Conceptually the battle is over, the peakists have won. … we are all peakists now."

* IEA, *Medium Term Oil Market Report*, July 2007

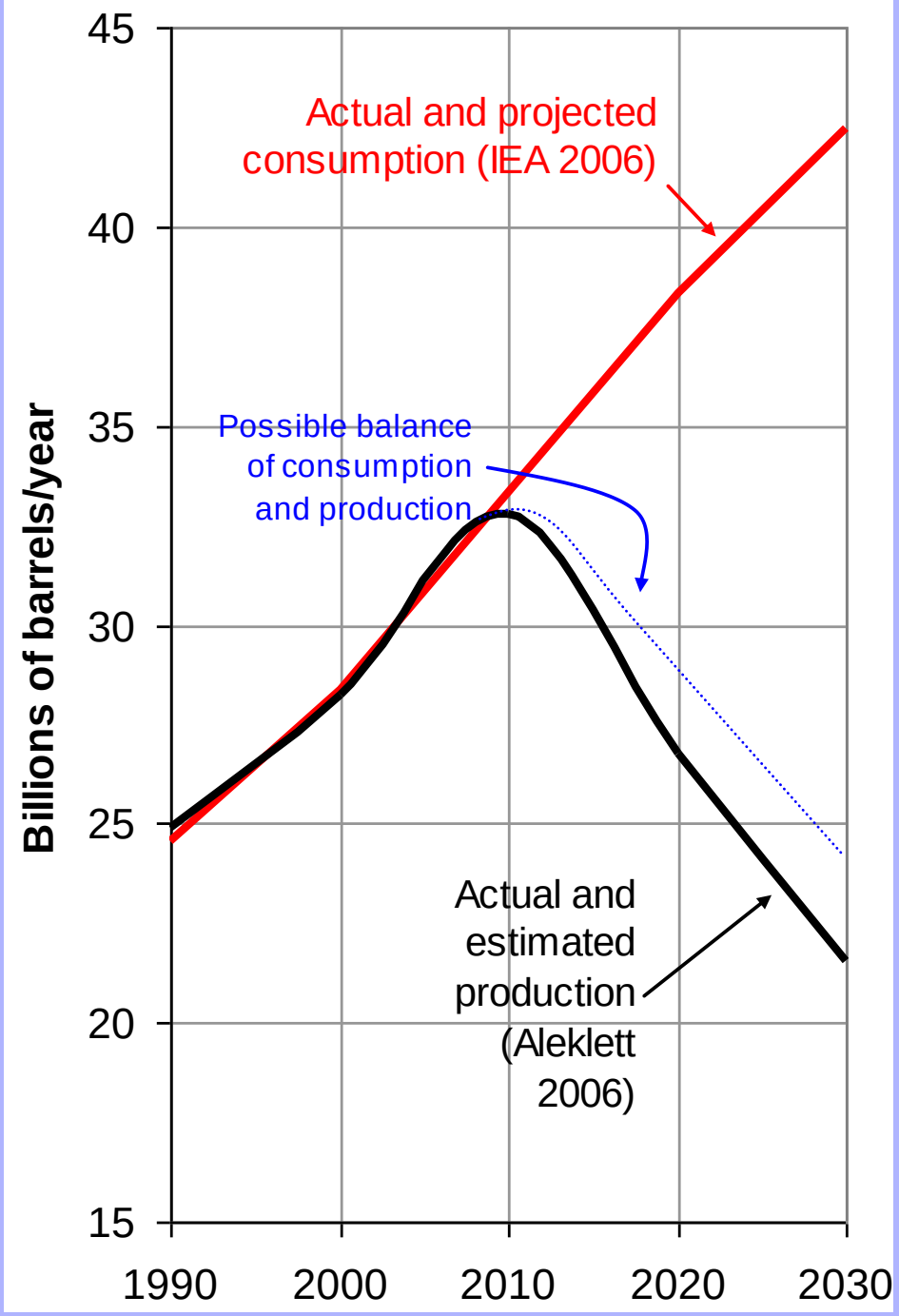
Best Guess: Global Peak by 2012



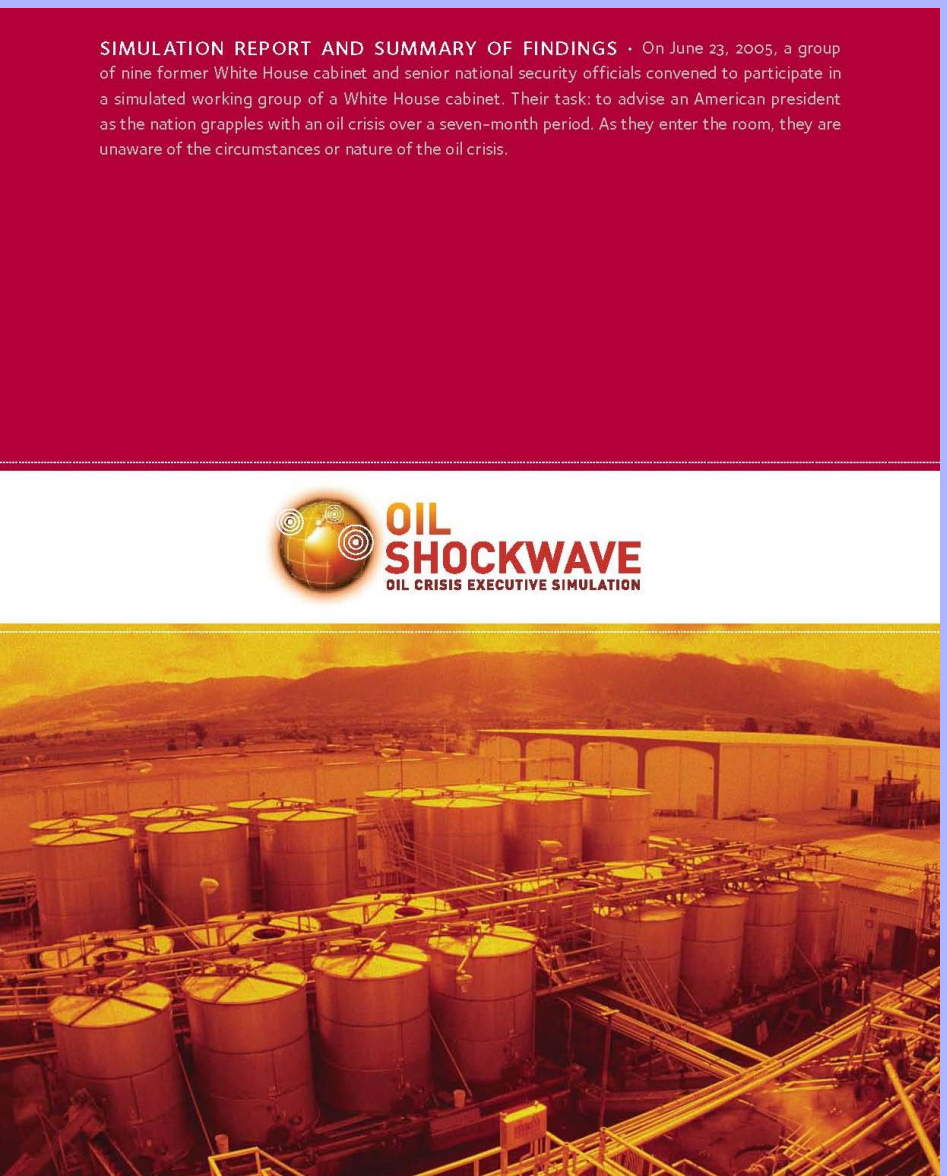
Concern About the Future Can Be Seen in Today's Price



Today's macro-economic models are of **little help** in predicting what would happen when demand greatly exceeds supply



Scenario Models Yield Steep Increases

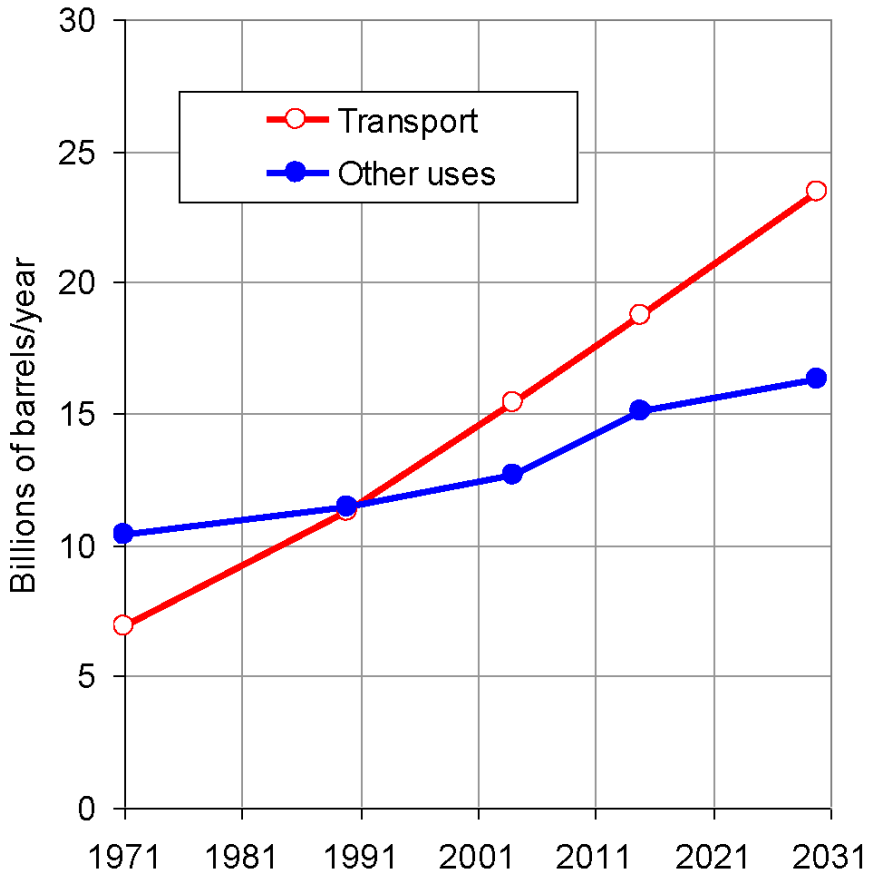


- National Commission on Energy's 2005 simulation suggested 4% shortfall in global supply would yield 177% price increase.
- Brookings 2001 study by Perry claims that a 15% gap would yield 550% price increase.

Somewhere between a future doubling and tripling of energy prices, one (or more) of three things will happen:

1. **Anticipatory programs** that enable an effective response to oil depletion will kick in.
2. **Emergency legislation** that echoes the 'New Deal' response to economic crisis.
3. **Wars** will be fought directly and overtly to access remaining oil.

Transport is likely to be more severely impacted than other sectors.



Sources: International Energy Agency (2004, 2004, 2006)

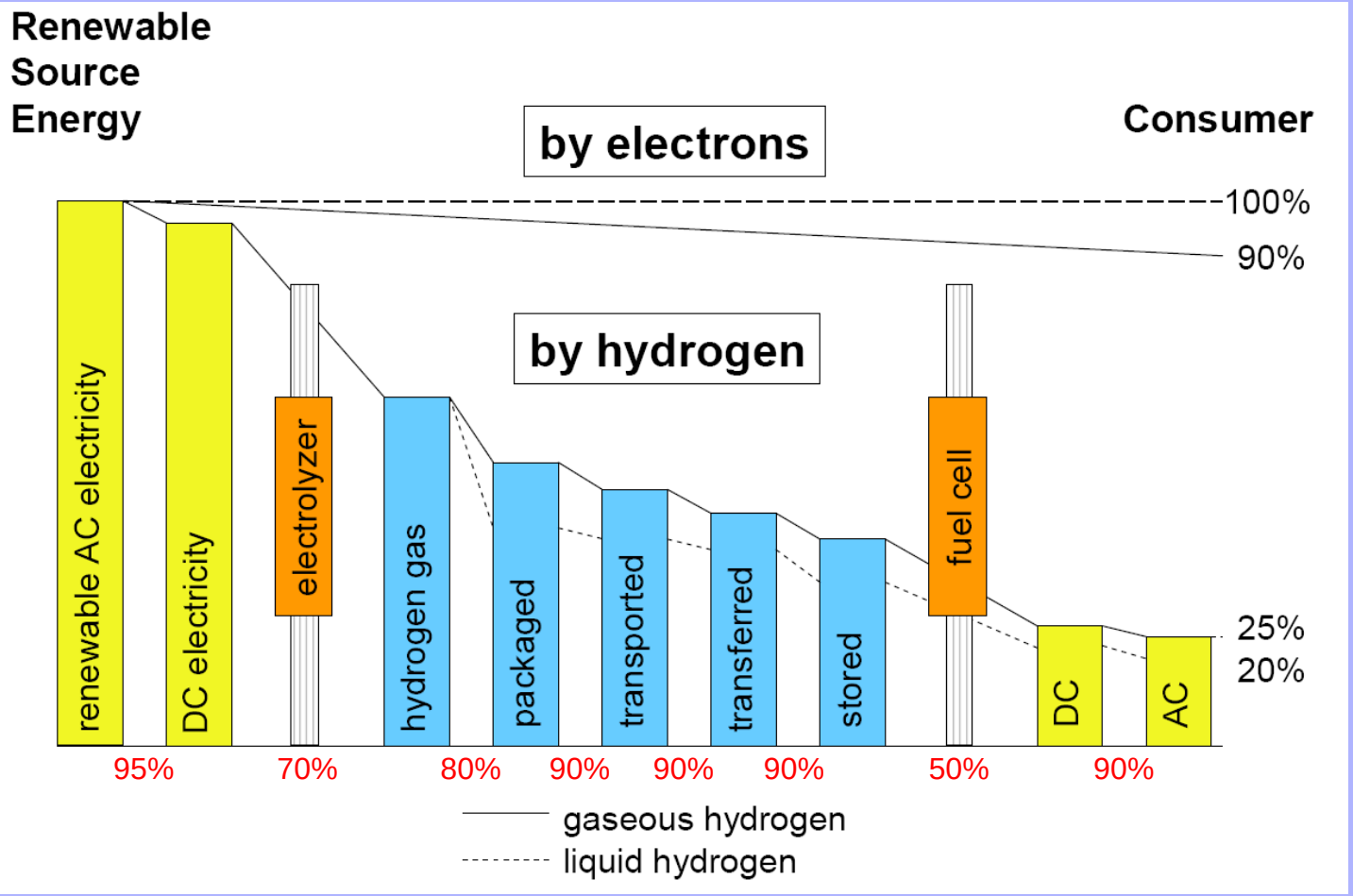
With shrinking oil availability and higher prices, our future will depend on transport revolutions

This is not a transport revolution

We Won't Have The Luxury of Time to Perfect "Hydrogen Highways"

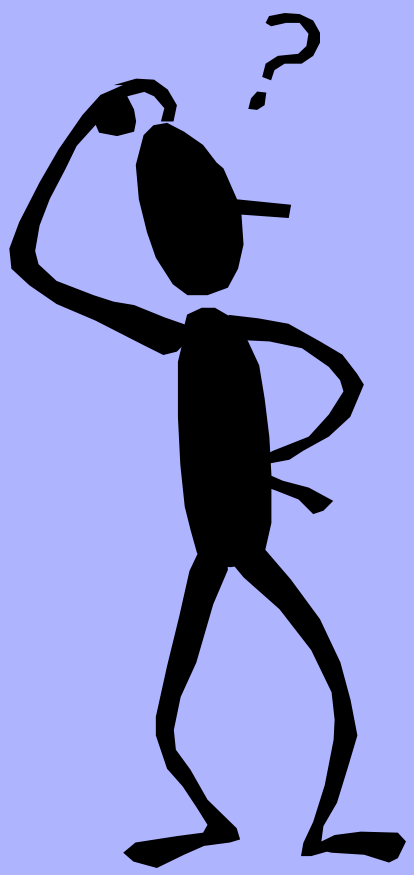
People will be running on empty long before these alternatives could provide a workable alternative to today's motor vehicles

We Won't Have the Luxury of Extra Energy To Power Most Vehicles With Fuel Cells



Source: Bossel (2005)

What are transport revolutions?



- A *substantial change* in a society's transport *activity* —moving people or moving freight, or both — that occurs in less than 25 years.

- Substantial change means a 50% increase or decrease in transport activity or use of a new means of transport becomes part of the lives of 10% of the society's population.

Transport revolutions that can address future oil depletion include:

- GREATER use of **electric motors** rather than internal combustion engines
- GREATER use of **rail and water** rather than road and air
- GREATER use of **collectively managed** rather than personally managed transport

This can be managed by a 5 step planning process for transport's energy redesign

1. Set the core parameter - how much to reduce liquid petroleum fuel use in transport between start and end of the plan.
2. Estimate current transport activity and energy use.
3. Anticipate future available modes and energy use.
4. Develop a plausible balance of future modes that reflects desired activity levels and energy use.
5. Engage in continuing refinement of energy use estimates and proposals for transport activity.

Our Example: 40% Less Oil Used To Move Americans by 2025

Values and totals in this table are rounded to aid comprehension Mode	2007				2025						
	pkm in billions (except per capita)	Fuel use per pkm, in MJ	Total liquid fuel use in EJ (GJ for per capita)	Total electricity use in EJ (GJ for per capita)	Local pkm in billions (except per capita)	Non-local pkm in billions (except per capita)	Fuel use per pkm in MJ	Total liquid fuel use in EJ (GJ for per capita)	Total electricity use in EJ (GJ for per capita)	Liquid fuel powered pkm	Electrically powered pkm
Personal vehicle (ICE)	7,700	2.6	20.4		2,300	2,000	2.1	9.0		4,300	
Personal vehicle (electric)					*1,000*		*1.0*		*1.0*		*1,000*
Future transport					*200*		*0.5*		*0.1*		*200*
Local public transport (ICE)	50	2.8	0.1		100		2.0	0.2		100	
Local public transport (electric)	*40*	*0.6*		*0.0*	*400*		*0.5*		*0.2*		*400*
Bus (inter-city, ICE)	200	0.7	0.1			500	0.5	0.3		500	
Bus (inter-city, electric)						*500*	*0.4*		*0.2*		*500*
Rail (inter-city, ICE)	6	0.9	0.0			100	0.6	0.1		100	
Rail (inter-city, electric)	*3*	*0.3*		*0.0*		*400*	*0.2*		*0.1*		*400*
Aircraft (domestic)	950	2.0	1.9			600	1.8	1.1		600	
Aircraft (international)	330	2.3	0.8			400	2.1	0.8		400	
Airship (dom. and int.)						100	1.2	0.1		100	
Marine (dom. and int.)						100	0.7	0.1		100	
Totals	9,300		23.4	0.0	4,000	4,700		11.7	1.6	6,200	2,500
Per capita	30,500		76.5	0.1	24,500			32.8	4.5		

Freight also sees major shift to rail & water

Values and totals in this table are rounded to aid comprehension Mode	2007				2025					
	tkm in billions (except per capita)	Fuel use per tkm, in MJ	Total liquid fuel use in EJ (GJ for per capita)	Total electricity use in EJ (GJ for per capita)	tkm in billions (except per capita)	Fuel use per tkm in MJ	Total liquid fuel use in EJ (GJ for per capita)	Total electricity use in EJ (GJ for per capita)	Liquid fuel powered tkm	Electri-cally powered tkm
Lorry (ICE)	2,050	2.6	5.4		1,000	2.0	2.0		1,000	
Lorry (battery)					*500*	*1.0*		*0.5*		*500*
Lorry (trolley)					*500*	*0.8*		*0.4*		*500*
Rail (ICE)	2,650	0.2	0.6		900	0.2	0.0		900	
Rail (electric)					*2,700*	*0.1*		*0.2*		*2,700*
Pipeline	1,250	0.5	0.6		800	0.3	0.3		800	
Air (domestic)	15	23.0	0.3		10	17.3	0.2		10	
Air (international)	25	9.9	0.3		25	7.4	0.2		25	
Airship (dom. and int.)					50	5.0	0.3		50	
Marine (domestic)	700	1.5	1.1		1,100	1.2	1.3		1,100	
Marine (international)	4,200	0.2	0.8		3,000	0.2	0.5		3,000	
Totals	10,900		9.0		10,600		4.6	1.1	6,850	3,700
Per capita	35,600		29.7		29,800		13.0	3.0		

We use Calgary as an example of the innovation that could unlock future transport revolutions

North America's first 100% renewable energy rail transit

Calgary Transit Runs North America's Most Successful New LRT System

- Very well patronized.
- Good fit into the urban fabric of business district.
- Supportive business community and government.

Green Entrepreneurs Lay Groundwork to Take Advantage of Deregulation

- Obtain federal funding.
- Build rural support from “wind farmers.”

Alberta's Renewable Energy Supply Got Connected to Rail Transit Early

- ENMAX signs 10 year contract to purchase 26,000 MWh annually from VisionQuest WindElectric.
- VisionQuest leverages funding to install 12 wind turbines @660 kW by September 2001.
- Transalta buys into this innovation.

What Would It take to connect all of Calgary's neighbourhoods by electric transit?

Padua's Guided Light Tram will provide LRT performance with shared street space - at a fraction of the cost of LRT.

Personal Rapid Transit could become the main local travel mode for new car-free neighbourhoods

How will Alberta's inter-city transport get beyond oil?

Edmonton – Calgary – Banff/Lake Louise could support an electrified rail corridor.

Synergy exists between new private and public electric vehicles

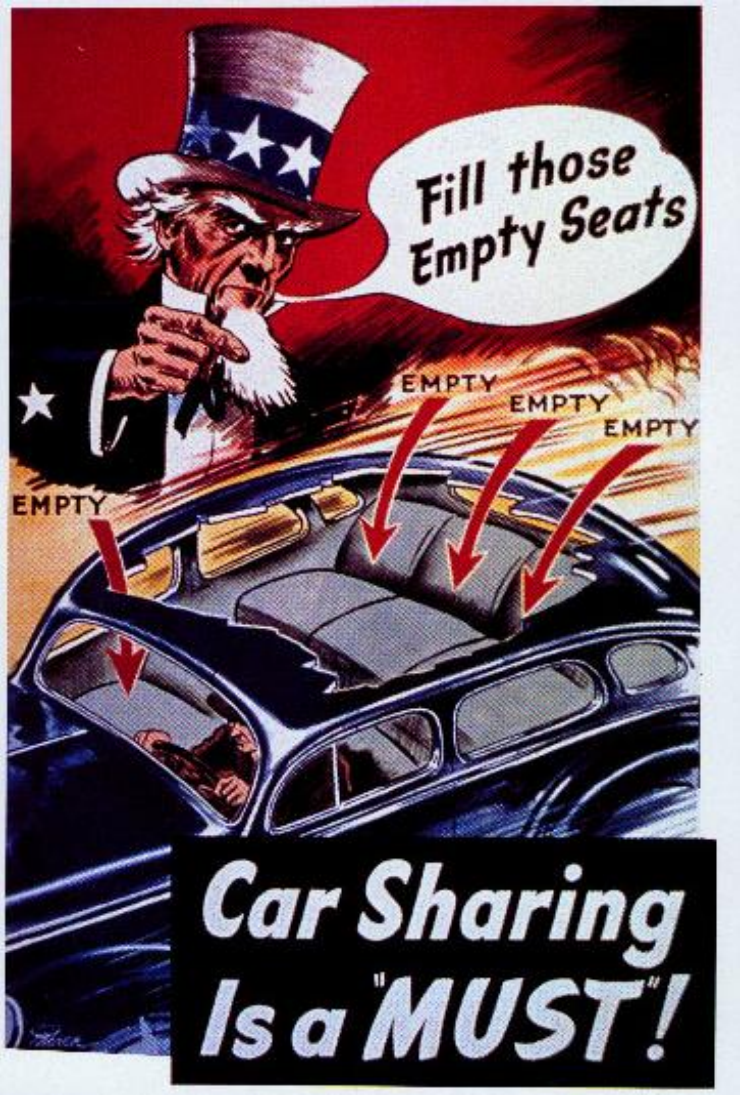
Electric traction corridors – essential “backbone” of future mobility

Electric cars, buses and trucks could all draw power while in motion from a common grid

Behavioral changes ahead will be much less traumatic than current transportation models assume

Smoking provides a relevant example

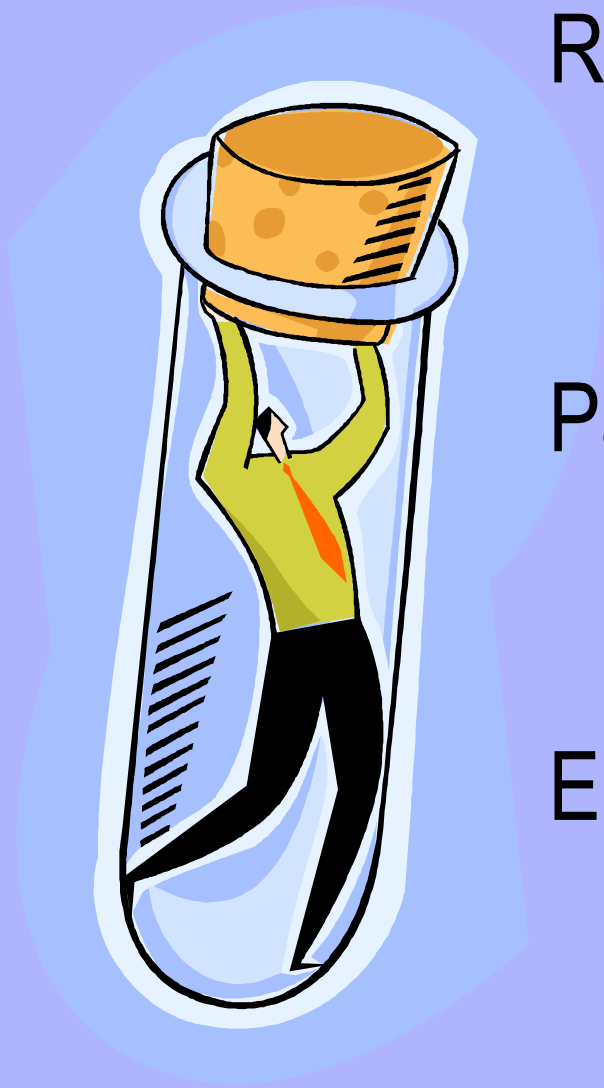
Leadership Has Changed Unsustainable Travel Behaviour Before



Freight Railroads' Growth is Limited by Existing Infrastructure

Capital Markets Show Little Interest in Competing With Public Highway Investment

Develop a rail policy that can enable us to cope with oil depletion



Rail is **institutionally excluded** from proven planning and finance arrangements.

Passenger rail management is **organizationally encumbered** compared to other carriers.

Electric train technology has become an **industrial orphan** compared to other modes.

Partnerships Will Be Needed to Grow Passenger and Freight RRs in harmony

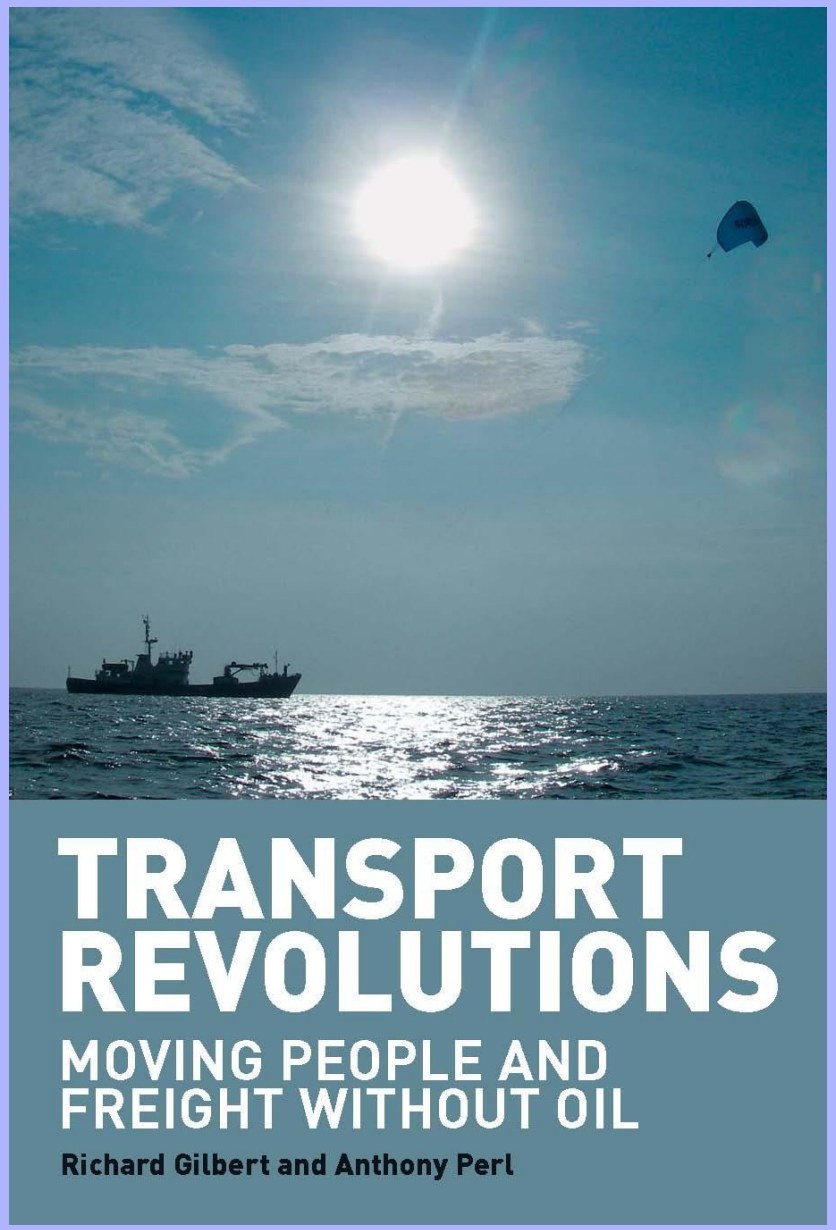
- Create a means for public finance of rail infrastructure that enables trains to fill in for road freight and air passenger travel.
- Offer a way for freight railroads to buy into the resulting success.

Where to start?

Key principle:
When you need to get out of a hole, the first thing to do is STOP DIGGING.

Aviation and highway expansion must pause soon, in order to begin redeploying resources.

Questions?



For further information about our book, visit:

www.transportrevolutions.info