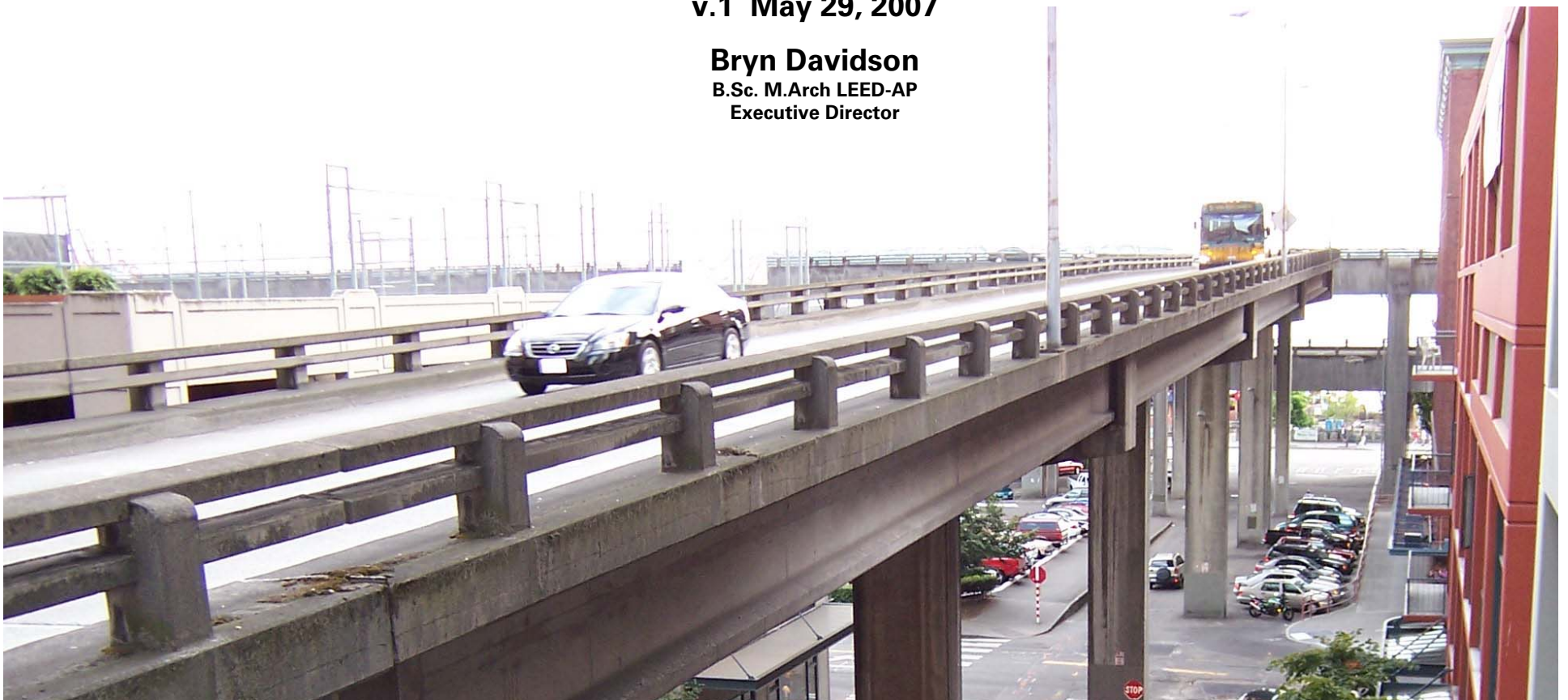


Scenario Based Transport Planning

Incorporating alternative futures
into transport project planning

v.1 May 29, 2007

Bryn Davidson
B.Sc. M.Arch LEED-AP
Executive Director



Peak Oil and Climate Change are unprecedented global challenges that are creating an entirely new context for global development.

In response, we need to fundamentally change the way we plan our cities.

It is our belief that every major project that will serve us from 2015 to 2050 (and beyond) needs to be planned using a scenario-based analysis.



This presentation uses a large highway replacement project in Seattle as a test case for scenario-based transport planning.

The Alaskan Way Viaduct needs to be replaced.

The aging structure is unsound and at risk for seismic damage.

The viaduct is one of two major north-south corridors going through downtown Seattle.

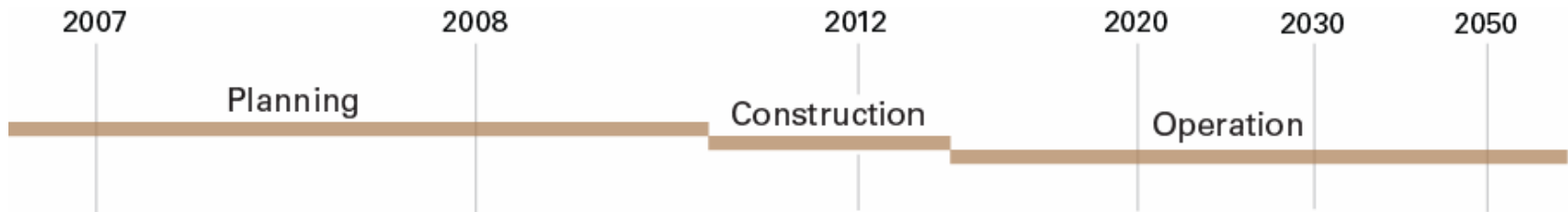


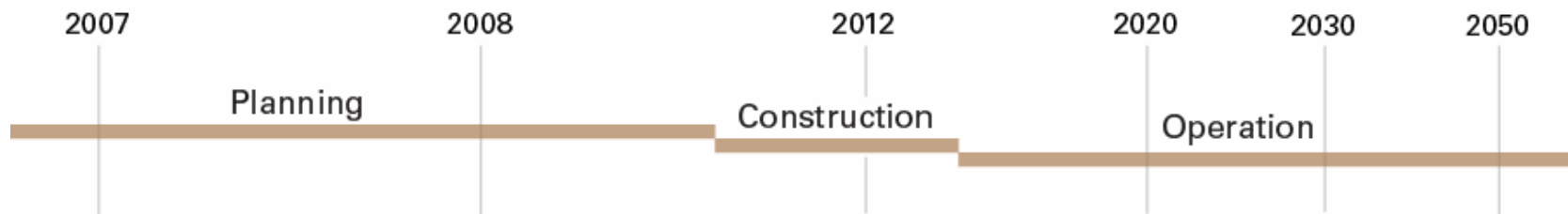
The Alaskan Way Viaduct: Seattle, WA



Source: "THE ALASKAN WAY VIADUCT REPLACEMENT PROJECT: AN OPPORTUNITY TO RETROFIT SEATTLE FOR SUSTAINABLE TRANSPORTATION"
Kamala Rao, M.Sc. Thesis. University of British Columbia

The multi-billion dollar project has been in the planning stage for many years, and will likely be operating during the period ~ 2015-2050.

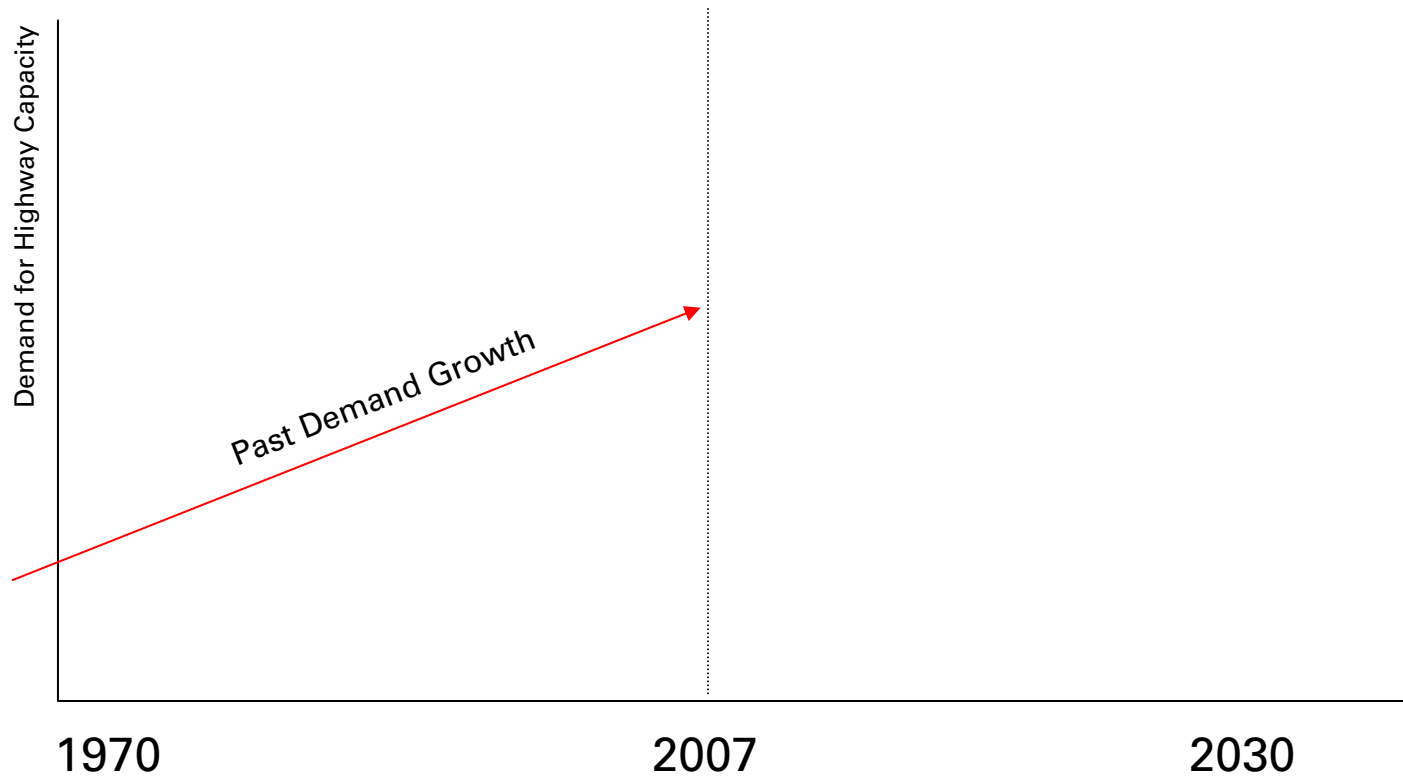




Three options are currently being considered:

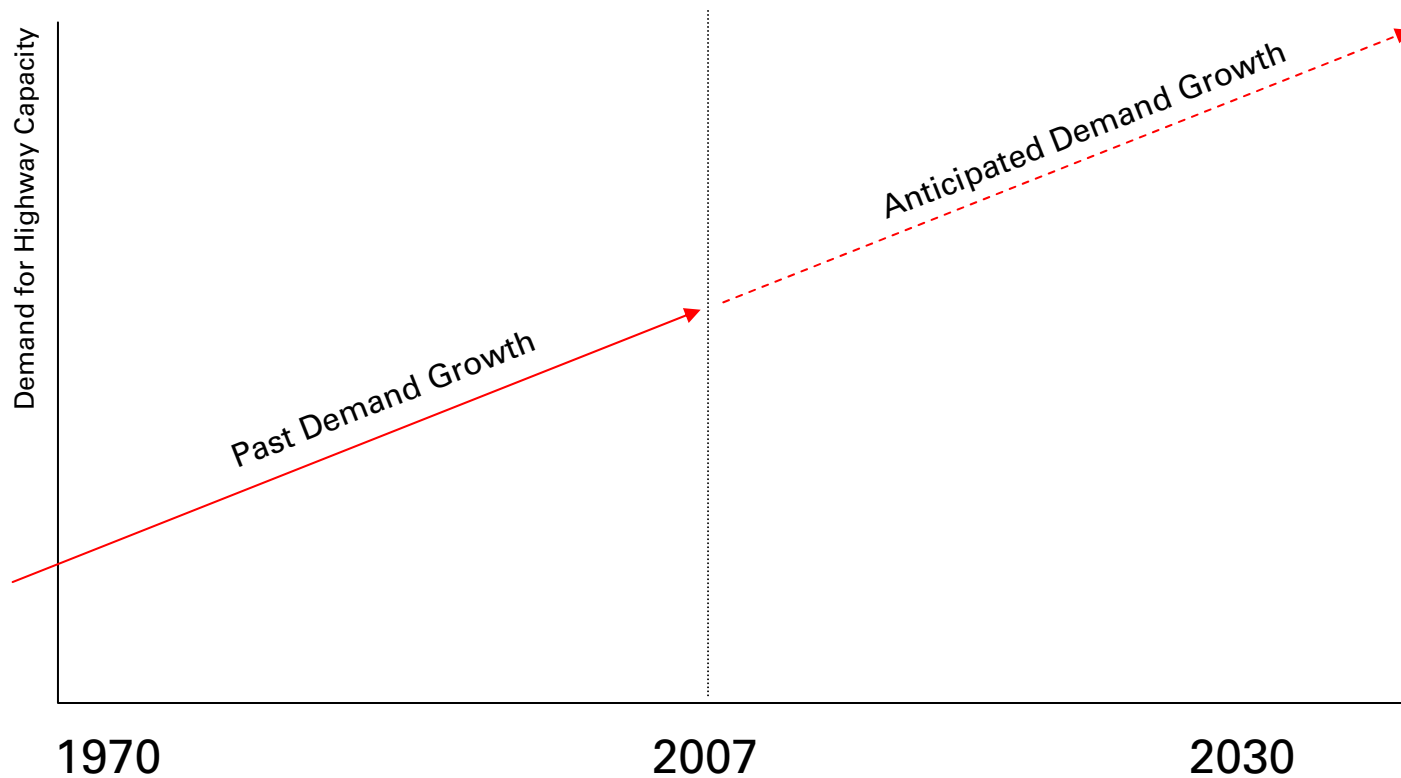
1. Replace the existing viaduct with a new (larger) elevated highway.
2. Replace the viaduct with a Tunnel (similar to Boston's 'Big Dig') and develop the waterfront land.
3. Replace the viaduct with surface streets & transit and develop the waterfront land.

Currently, transportation planning is based on a 'predict and provide' model where past growth is extrapolated, into the future, to predict future transport demand.



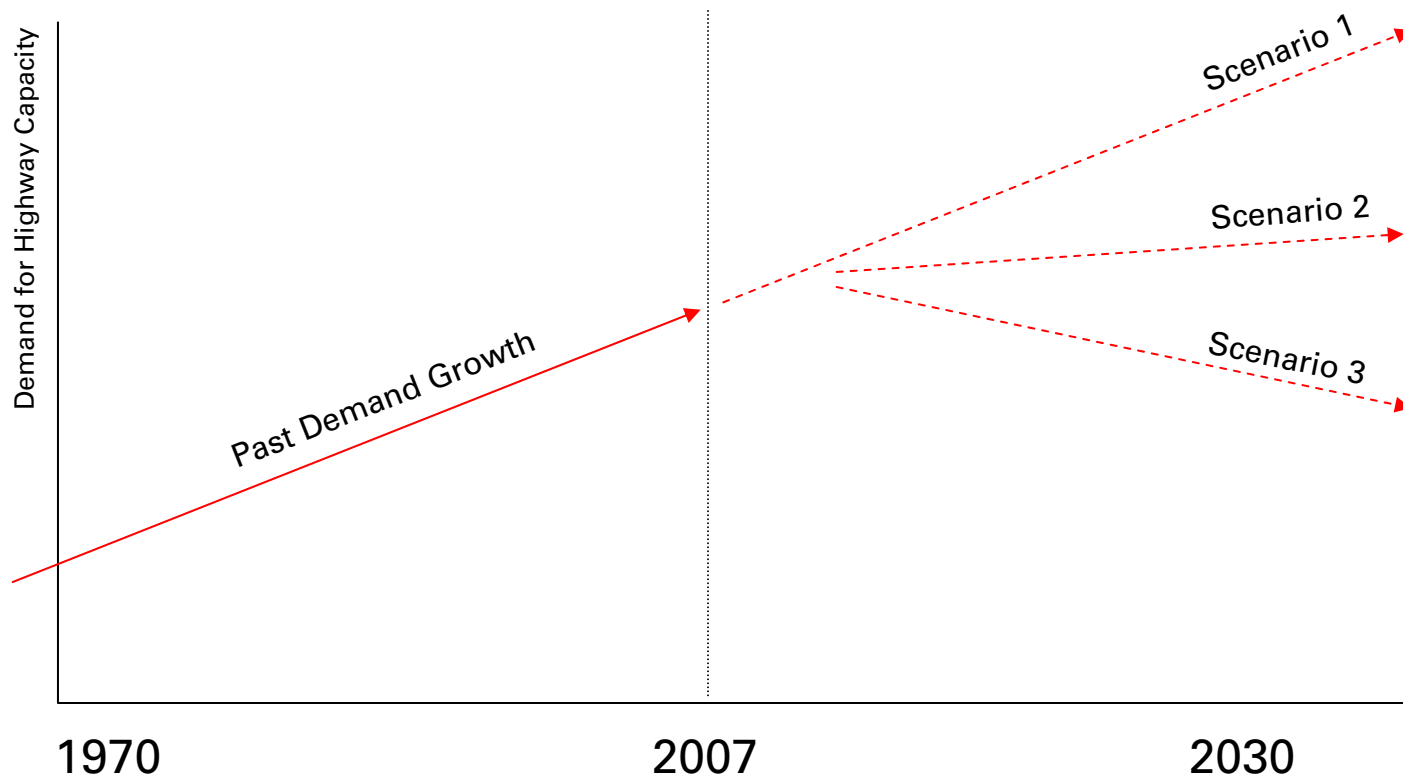
Currently, transportation planning is based on a 'predict and provide' model where past growth is extrapolated, into the future, to predict future transport demand.

Institutions (like the Washington State Dept of Transportation) create these extrapolated demand models.

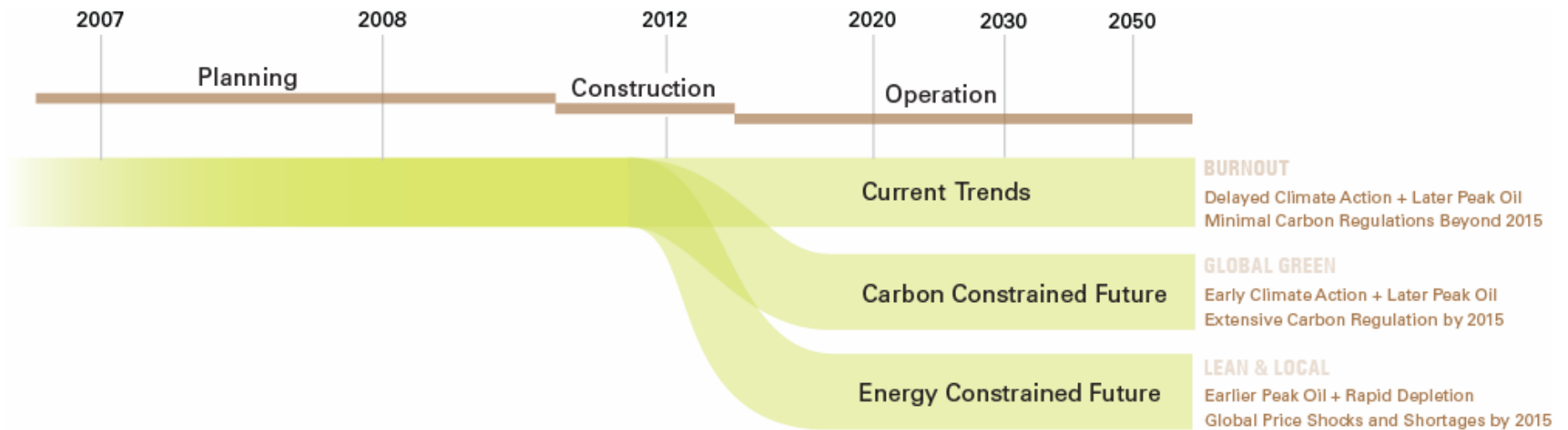


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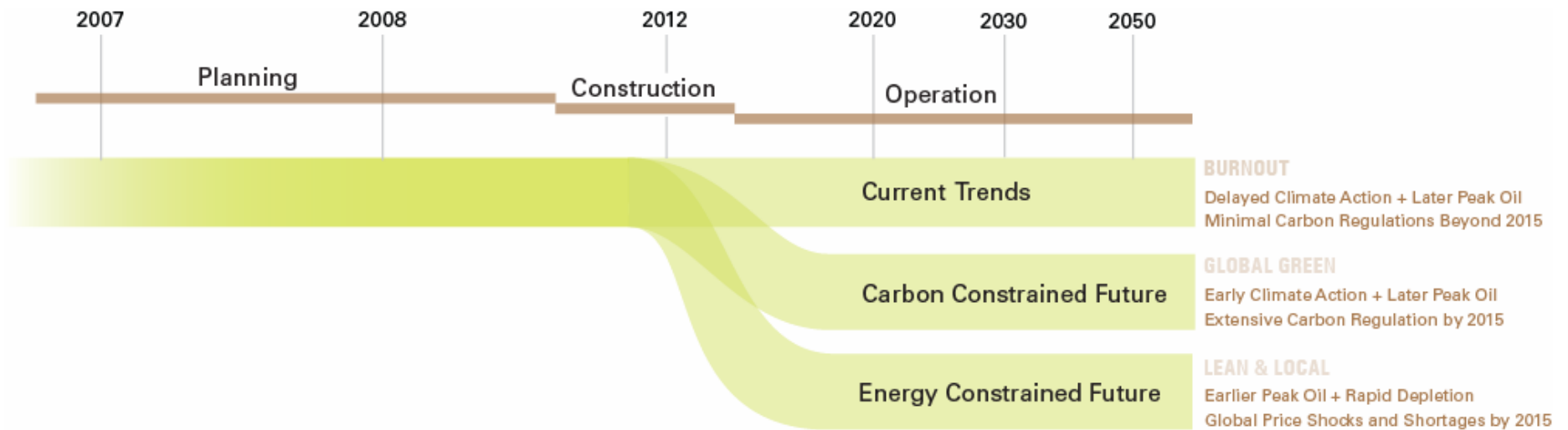
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In each scenario, the predicted demand for different forms of transport varies.

For instance, in an energy constrained future, the demand for air travel will likely shrink vs. growing at the rate predicted by the 'Current Trends' model.

For this analysis, we make a variety of assumptions about changes in demand for each scenario.

Scenario-Based Transport Planning

Annual Demand Growth Scenarios 2012-2050

	Current Trends <i>Delayed Climate Action + Later Peak Oil Minimal Carbon Regulations Beyond 2015</i>	Carbon Constrained Future <i>Early Climate Action + Later Peak Oil Extensive Carbon Regulation by 2015</i>	Energy Constrained Future <i>Earlier Peak Oil + Rapid Depletion Global Price Shocks and Shortages by 2015</i>
Transport Demand Growth (GJ consumed by transport mode*)	+ 3%	0 %	- 3 %
SOV Demand Growth	+3 %	- 1 %	- 5 %
Long Haul Trucking Demand Growth	+ 3 %	- 1 %	- 10 %
Heavy Rail Demand Growth	+ 1 %	+ 3 %	+ 1 %
Airline Demand Growth	+ 2 %	- 3 %	- 10 %
Transit / Alternatives Demand Growth	0 %	+ 5 %	+ 10 %

* Energy Consumption by Mode (GJ) = production, operation, maintenance & infrastructure

Scenario-Based Transport Planning

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In many infrastructure projects, the 'facts' are actually opinions acclaimed by consensus.

In the same manner, it is feasible to construct a consensus based approach to scenario planning by assigning a 'likelihood' to each scenario.

Scenario-Based Transport Planning

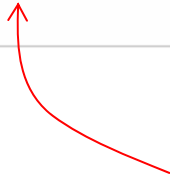
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Scenario Probability (Regional Consensus, Total = 100%)	30 %	40 %	30 %

Scenario-Based Transport Planning

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This assumes, of course, a base level of energy literacy among professionals, decision makers and the public.

Comparing the options...



1. Replacement



2. Tunnel

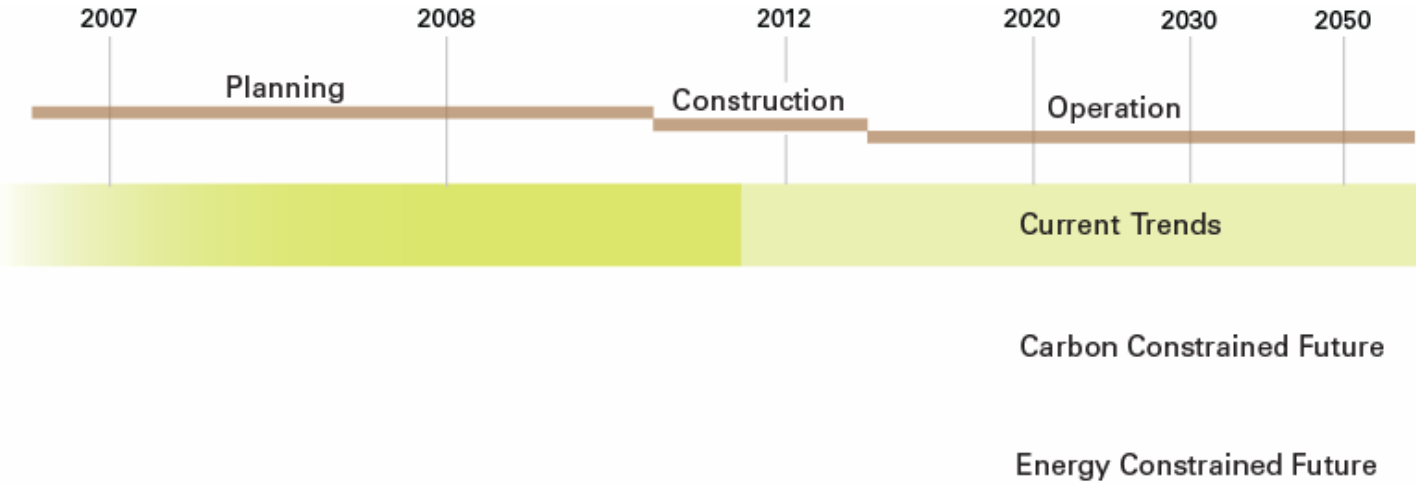


3. Surface 'streets and transit'

Existing elevated highway



Comparing the options...



Current Trends Scenario



1. Replacement

Medium / High Up-Front cost.

Expands road capacity.

Maintains status-quo 'barrier' to the waterfront.



2. Tunnel

Highest Up-Front Cost.

Expands road capacity while allowing for improvements to the waterfront.



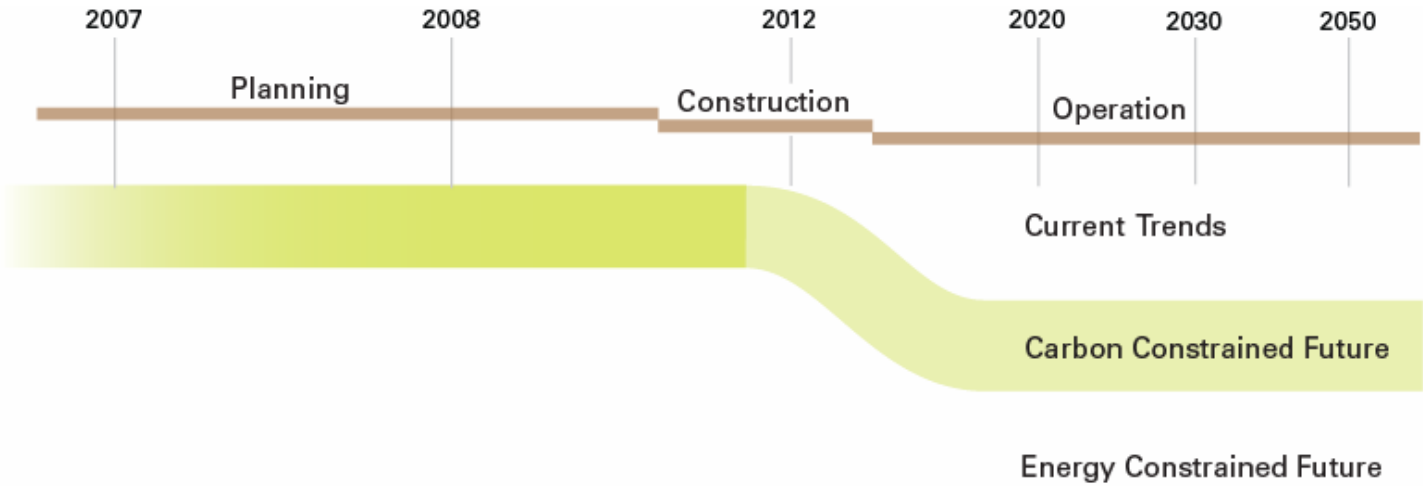
3. Surface 'streets and transit'

Lowest Up-Front Cost.

Reduces peak road capacity while allowing for improvements to the waterfront.

Would require more careful coordination of trucks for regional goods movement.

Comparing the options...



Carbon-Constrained Future



1. Replacement

Encourages increased emissions from cars & trucks.

Maintains status-quo goods movement in the short term, but reduces Seattle's potential competitiveness in a carbon-constrained global economy.



2. Tunnel

Encourages increased emissions from cars & trucks but provides opportunities for transit and new density.

Maintains status-quo goods movement in the short term but siphons money from other low-carbon transport projects that would support the economy through 2050.

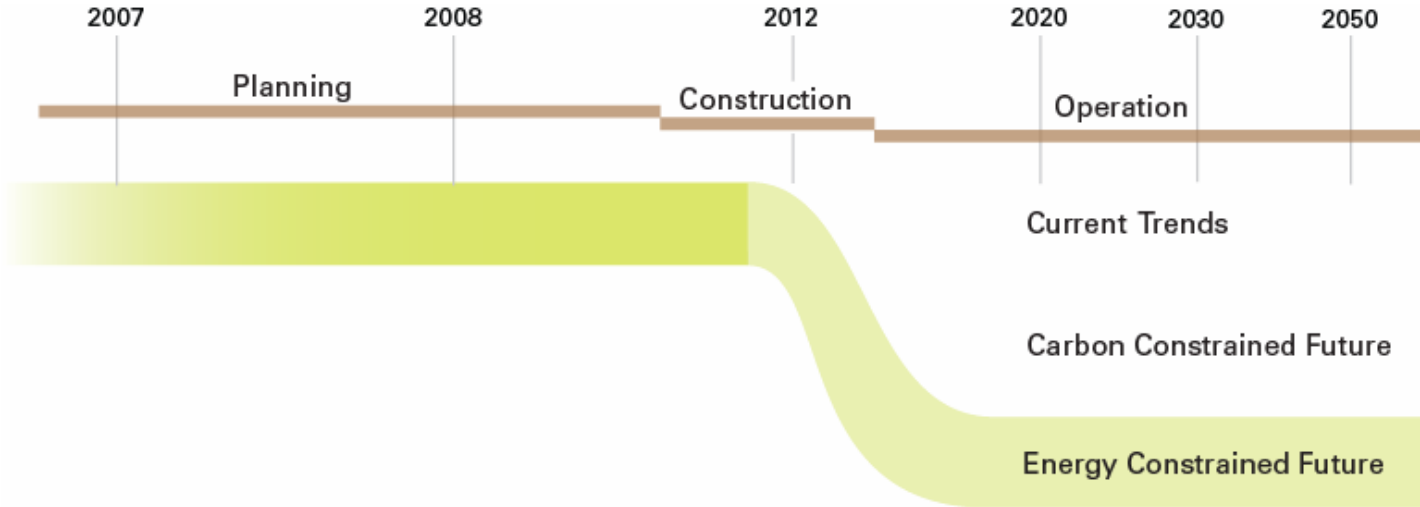


3. Surface 'streets and transit'

Reduces emissions while allowing project capital to be spent on other emissions-reducing projects.

Increases Seattle's livability and competitiveness in a carbon-constrained future.

Comparing the options...



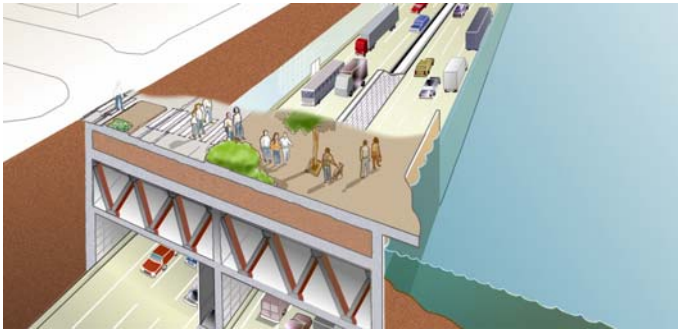
Energy-Constrained Future



1. Replacement

Encourages increased emissions and dependence on oil in the short term.

Becomes a stranded investment over the long term as fuel shortages lower the demand for highway capacity.



2. Tunnel

Encourages increased emissions and dependence on oil in the short term.

Siphons money from projects that would support reduced emissions and economic re-localization.



3. Surface 'streets and transit'

Reduces emissions while allowing project capital to be spent on other projects that reduce oil-dependence.

Increases Seattle's livability and competitiveness in an energy-constrained future.

Comparing the options...
..side by side.

Scenario Based Options Analysis:

Seismic Retrofit of Seattle's Waterfront Highway

(The Alaskan Way Viaduct)

Current Trends
Delayed Climate Action + Later Peak Oil
Minimal Carbon Regulations Beyond 2015

Carbon Constrained Future
Early Climate Action + Later Peak Oil
Extensive Carbon Regulation by 2015

Energy Constrained Future
Earlier Peak Oil + Rapid Depletion
Global Price Shocks and Shortages by 2015

Scenario Probability (Regional Consensus, Total = 100%)

30 %

40 %

30 %

Project Value = (NPV - Opportunity Cost) 2012-2050

Score [-5 , +5] Score weighted by scenario likelihood

	Current Trends		Carbon Constrained Future		Energy Constrained Future		Total
1 Replace Viaduct with New Elevated Highway	1	3	-3	-12	-5	-15	- 24
2 Replace Viaduct with Tunnel	3	9	-3	-12	-5	-15	- 18
3 Replace Viaduct with Surface Transit and Streets	2	6	3	12	0	0	+ 18

* Energy Consumption by Mode (GJ) = production, operation, maintenance & infrastructure

Scenario Based Options Analysis:

Seismic Retrofit of Seattle's Waterfront Highway

(The Alaskan Way Viaduct)

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Ranking projects by their value
in a 'current trends' future.

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Ranking projects by their value across multiple futures

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(The Alaskan Way Viaduct)

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Planning for the Dynamic City



Ranking projects by their value across multiple futures

design
planning
policy for a
changing world

dynamic cities project

design
planning
policy for a
changing world



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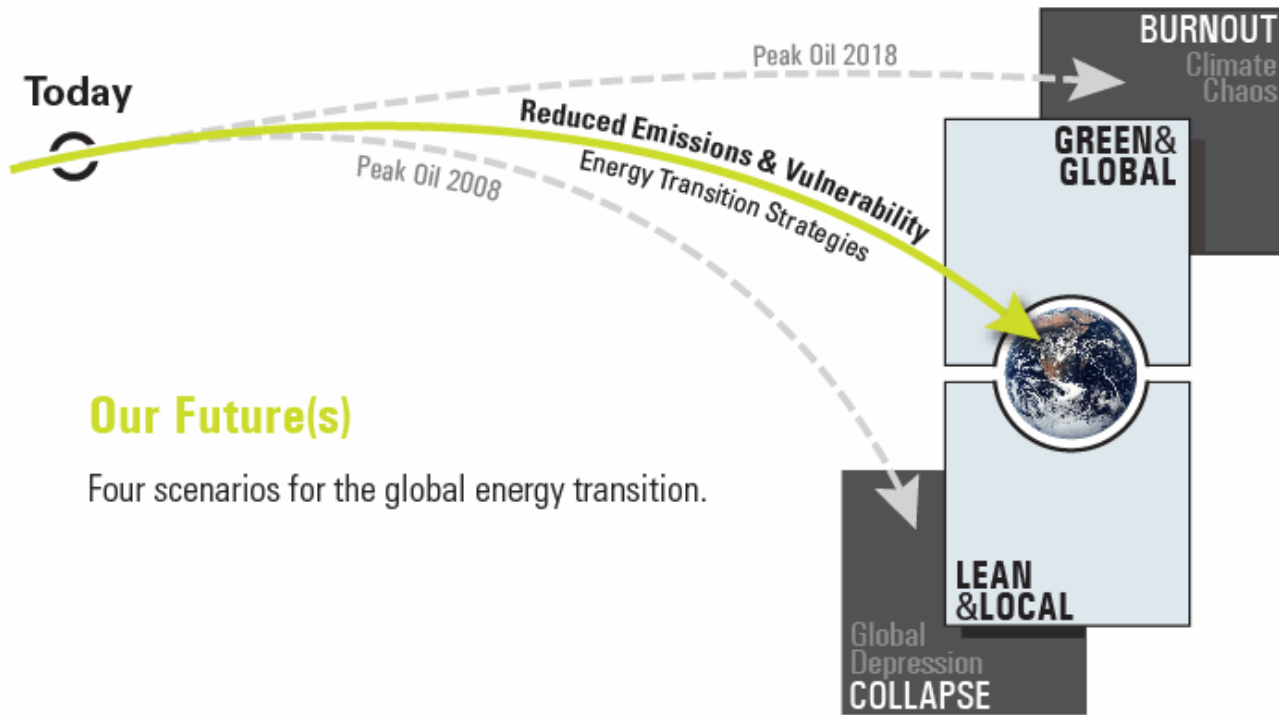
Bryn Davidson

bryn@dynamiccities.org

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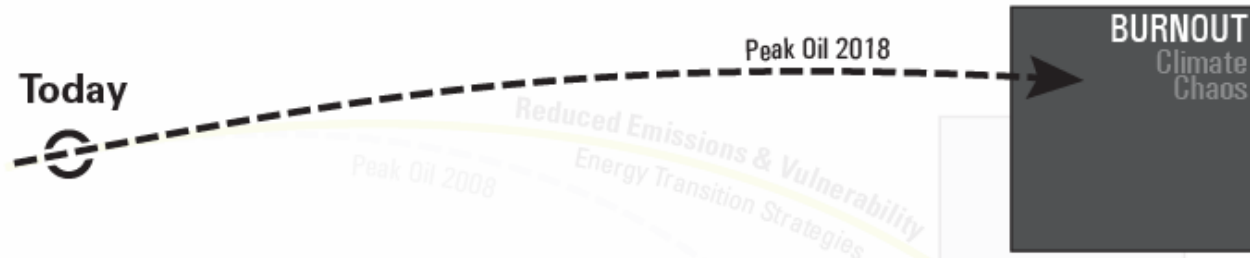


www.dynamiccities.org



Our Future(s)

Four scenarios for the global energy transition.



BURNOUT

Business as Usual Leading to Climate Chaos

Non-conventional fossil fuels offset depletion masking any overall 'peak' until 2018.

The price of oil hovers above \$70/bbl for several decades and drives a transition to coal, nuclear, and unsustainably sourced biomass.

CO2 emissions skyrocket, while habitats, farmland, and forests are decimated in a rush for wood and biomass.

Super storms, rising sea levels, and desertification cause massive refugee, food, and health crises.

Today



GREEN&GLOBAL

A Proactive Transition led by Technology and Markets

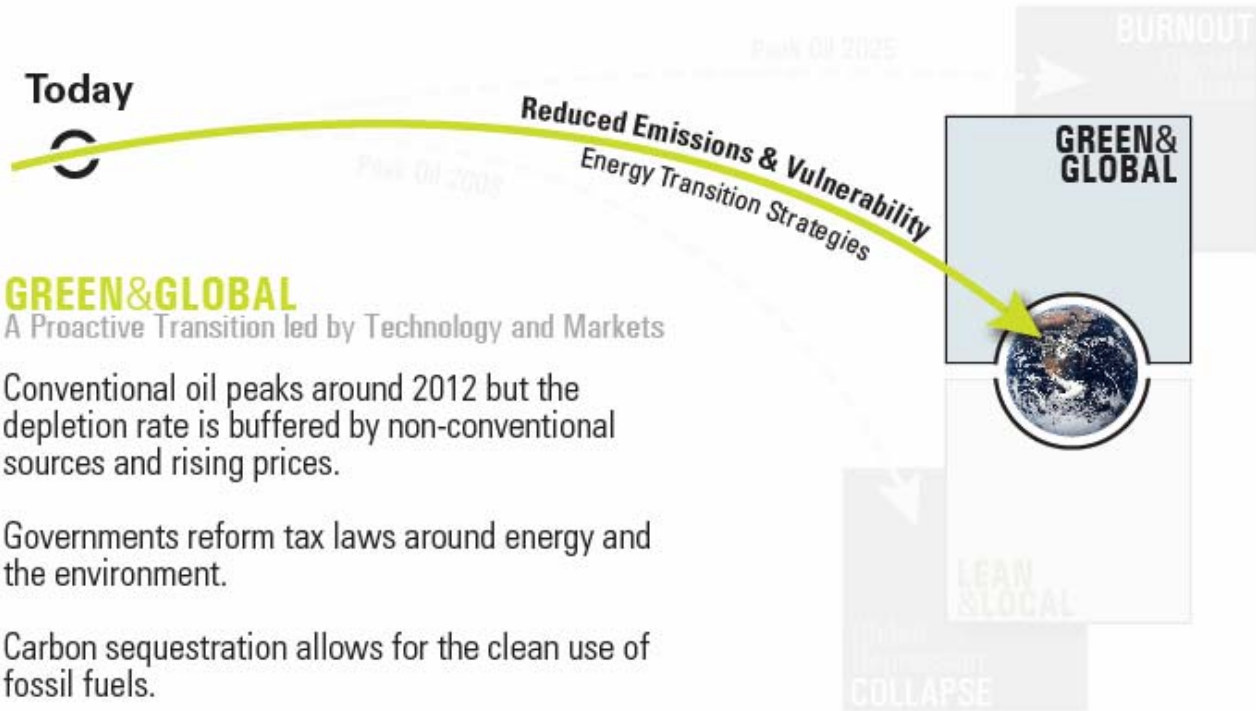
Conventional oil peaks around 2012 but the depletion rate is buffered by non-conventional sources and rising prices.

Governments reform tax laws around energy and the environment.

Carbon sequestration allows for the clean use of fossil fuels.

The 'Green' sector shows tremendous growth, while older industries decay.

Developing third-world economies 'leap-frog' to sustainable economies.



Today

LEAN&LOCAL

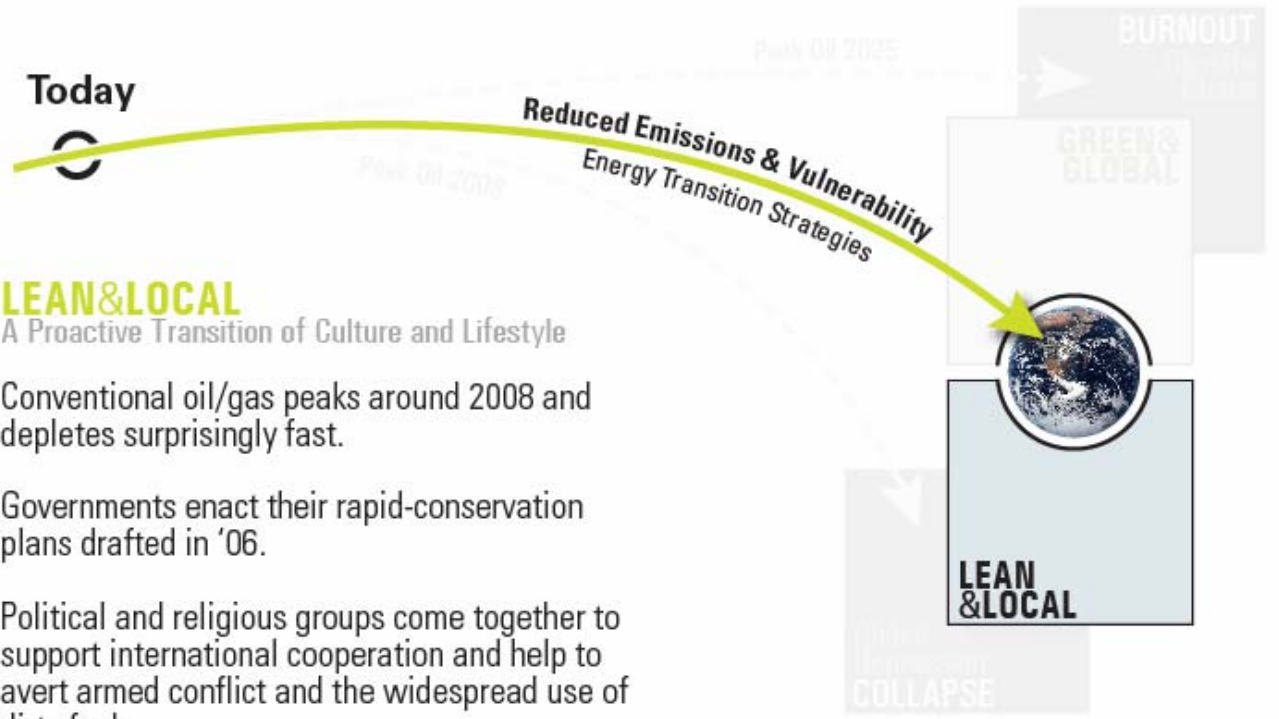
A Proactive Transition of Culture and Lifestyle

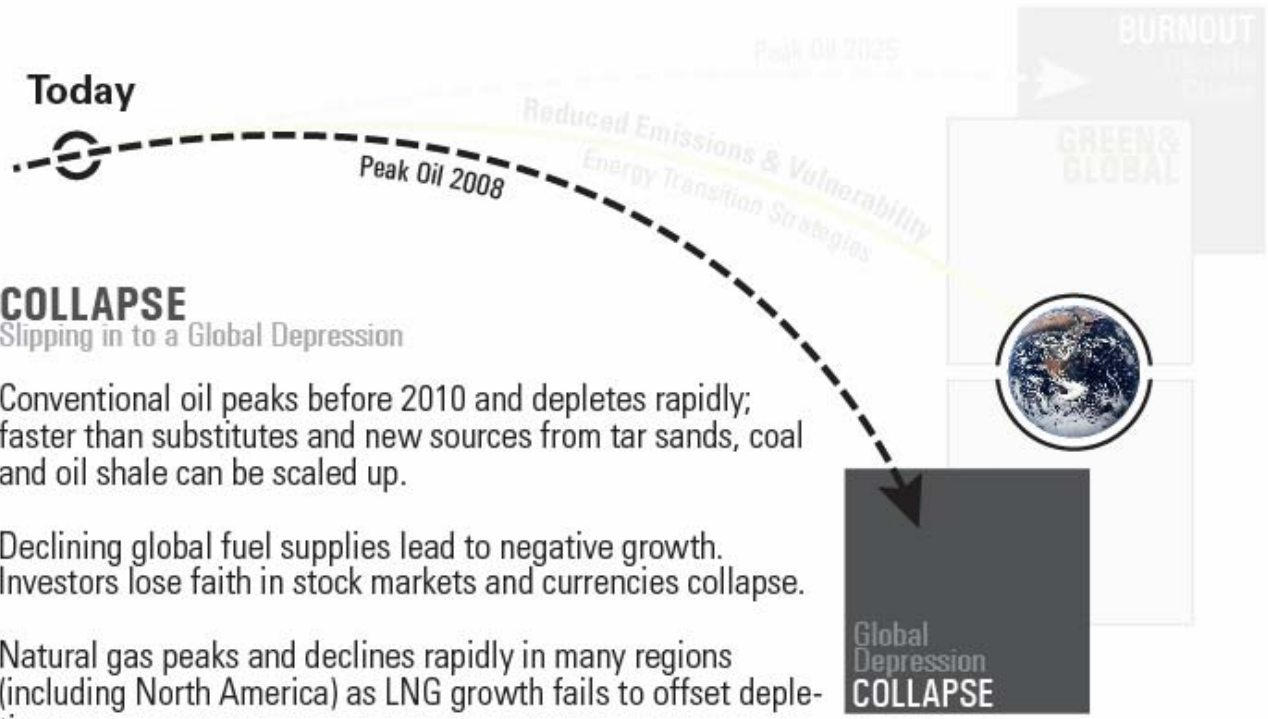
Conventional oil/gas peaks around 2008 and depletes surprisingly fast.

Governments enact their rapid-conservation plans drafted in '06.

Political and religious groups come together to support international cooperation and help to avert armed conflict and the widespread use of dirty fuels.

The global economy transitions (with the help of a few price and supply shocks) from a global-centric to a regional and local-centric model.





COLLAPSE
Slipping in to a Global Depression

Conventional oil peaks before 2010 and depletes rapidly; faster than substitutes and new sources from tar sands, coal and oil shale can be scaled up.

Declining global fuel supplies lead to negative growth. Investors lose faith in stock markets and currencies collapse.

Natural gas peaks and declines rapidly in many regions (including North America) as LNG growth fails to offset depletion.

Nations battle for resources abroad and fight unrest at home. Unemployment soars, global travel and the globalized economy collapse.

Health and food crises are rampant. Populations contract from lower birth rates and lower life expectancies.