Transportation Sustainability Issues

http://www4.uwm.edu/cuts/ite09.pdf

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Background: the four stages of grief

- Denial: It is not really happening, ignore it and it will go away
- Anger: It is someone else's fault, someone else has to deal with it.
- Negotiation: Maybe we can change a just a few things
- Acceptance: We are doomed

Definitions

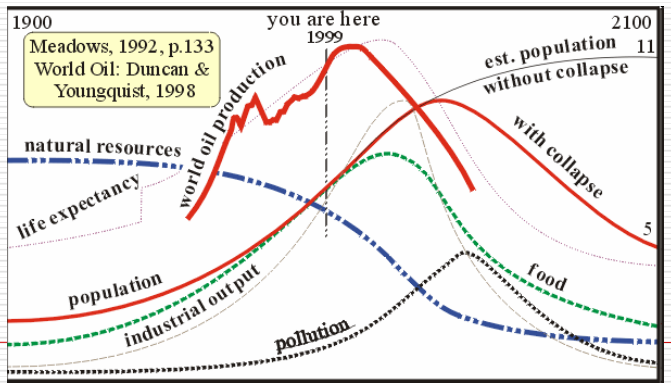
- Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs. (UN World Commission on Economic Development, 1987)
- Resources renew themselves at the same rate or faster than they are used.
- Example: sustainable forest: It supplies fuel, lumber, natural communities and food at a rate less than the rate they are replaced, forever.

What sustainability really means

- A system that is not sustainable it is a Ponzi scheme – borrow from the future to pay for the prersent
- A system that is not sustainable will eventually collapse,
- the only questions are
  - When and how the collapse will occur,
  - What happens during the collapse
  - What needs to be done to cushion the collapse

Sustainability

- Requires a change in mid set from thinking of growth to dynamics and equilibrium
  http://dieoff.org/page25.htm



What resources in transportation?

- In a sustainable system, resources need to renew themselves at the same rate or faster than they are used.
  - Money
  - People
  - Materials
  - Energy
  - Air, water and climate

Financial sustainability

- Rising costs
  - Materials and labor costs
  - Costs of mega-projects
  - Bonding
- Declining or flat revenues,
  - VMT growth is slowing,
  - More efficient vehicles
  - Diversion of transportation funds for other (worthy) purposes
- Pubic and political resistance to any tax or fee increases
- Earmarking.

People

- Universities are reluctant to hire faculty unless there is are assurances of research funding, (probably) from state sources.
  - Earmarking and cost share requirements limits other opportunities
  - Limited university resources especially in traffic engineering, public transit, highway design.
- Excessive outsourcing of engineering services can lead to lack of permanent expertise to oversee projects
- Inadequate preparation in mathematics and sciences by entering students, especially from urban schools, reduced summer job opportunities
- Undergraduates in the U.S. are reluctant to enter graduate school

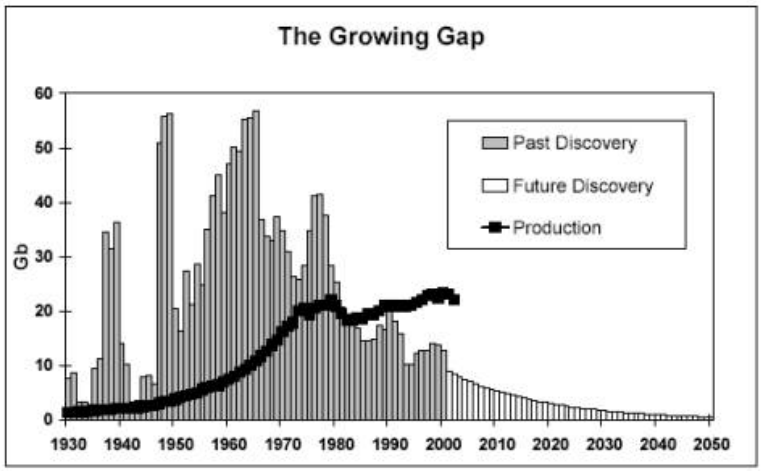
Materials sustainability

- Need to expand and enhance materials reuse and recycling
- Lack of maintenance leads to higher costs in the future. Good asset management needed.
- Local roads that use property taxes for support at seriously underfunded
- Need a ‘Leed certification’ program for transportation – What elements of design and construction give the best long term fit with the environment?

Energy (Petroleum) sustainability

- To be sustainable, oil supplies would need to be discovered and developed (or replaced) faster than they are being used, this has not been the case since about 1980.
- Well to wheel requirements: Net energy = energy produced – energy needed to produce the energy, newer sources require more energy to produce the energy
- System collapse is inevitable, probably in 10-30 years
- When it happens depends on primarily rate of increase in global demand for petroleum.

World Conventional Oil Production & Discoveries



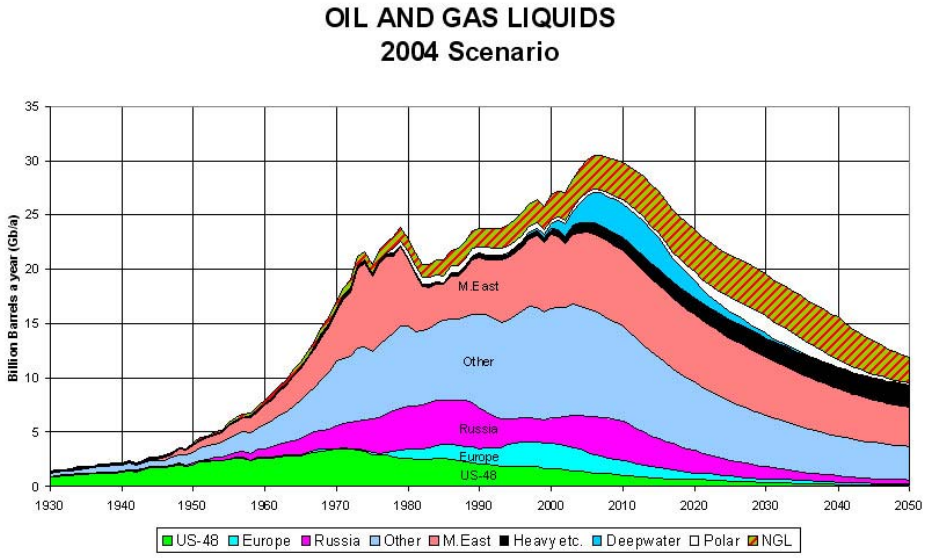
OIL DEPLETION -THE HEART OF THE MATTER, C.J.Campbell, *The Association for the Study of Peak Oil and Gas*

Some numbers

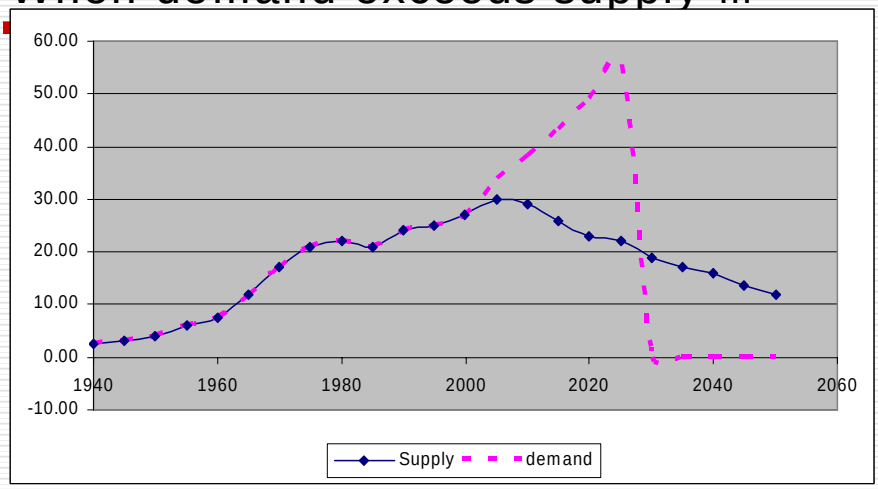
- World demand – 30 Billion barrels/yr expected to increase to 50 BB/yr
- U.S. demand – 7.5 Billion barrels/yr., about 5 Billion barrels/yr. imported
- US. Reserves – about 21 billion barrels from all sources – off shore, AWNR (4 Bbl), etc. global reserves 1 Trillion barrels ?
- Remaining sources require greater energy to extract. Net energy?
- http://tonto.eia.doe.gov/dnav/pet/pet_crd_gom_s1_a.htm

Supply = Area under the curve

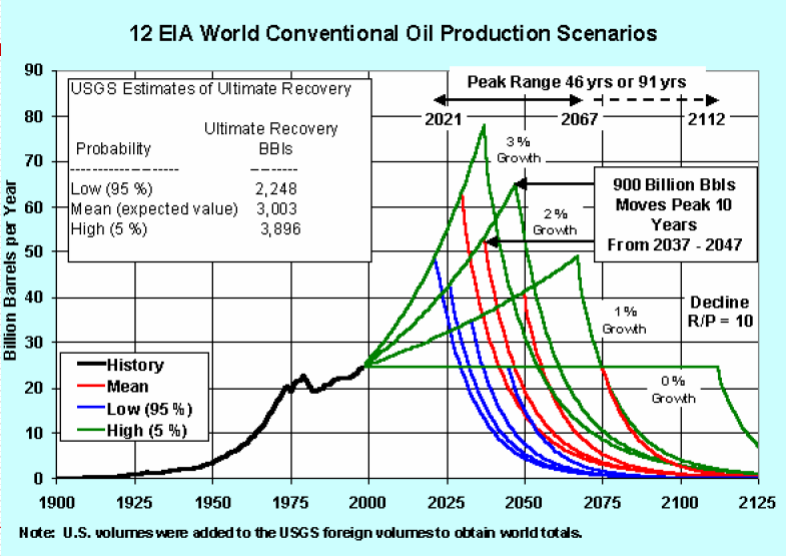
Campbell's prediction "the end of cheap oil"



When demand exceeds supply …



U.S. DOE viewpoint,
source:http://tonto.eia.doe.gov/FTPROOT/features/longterm.pdf#search='oil%20supply'



Petroleum Collapse - worst case

- Collapse of petroleum system could (will) have sever consequences
  - Investor speculation leading to wide price swings
  - Global economic recession/depression
  - Severe inflation
  - Removal of environmental controls over remaining resources
  - Most of the world, including the U.S. will be highly dependant on sources from a few mostly unfriendly, hostile foreign locations.
  - Transfer of wealth to countries with remaining resources
  - Political/military conflict over remaining resources
  - Rise of autocratic governments
  - Increasing poverty in third world countries

More bad news

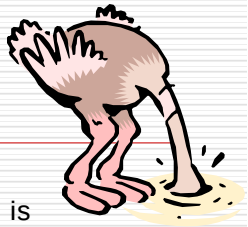
- If additional supply is found or developed, it can result in a delay of the collapse, but the magnitude of the collapse will be greater.
- Remaining sources require more energy input and are more difficult to process than in the past
- Alternate fuels require petroleum input to acquire and transport. (e.g. coal)
- Unstable prices discourage or delay investment in alternatives (alternative sources, fuels, technology, etc)

Even more bad news

- More efficient vehicles, price pressures and general conservation can delay the problem, but are not enough. “You can only turn off the lights once”
- Can Technology and Alternative Fuels solve the problems?
  - Possibly, in the long run, but some will take a long lead time to happen
    - Technology development - 6-15 years
    - Infrastructure deployment -10-15 years
    - Market penetration occurs along with above
    - Fleet turnover – 12 years
    - Total 20-40 years for full effect to be felt

The future?

The four stages of grief



- **Denial** – "It won't happen":
  - A question of risk, the prudent thing to do is prepare for the worst, hope for the best,
  - Similar to preparation of a disaster plan
  - "If it could happen, it will happen" So, what strategies should be used when it does happen?
  - Most sustainability actions are good things to do anyways
- **Anger** – "Blame someone else":
  - Useless, the problems don't go away
- **Acceptance** – "We are doomed"
- **Negotiation**
  - what can we do to create momentum to move in a different direction:

Financial sustainability

- Learn to do more with less - fix it first?
- Invest in preventative maintenance
- Improved operations of existing facilities.
- Spread the message, if the experts don't, who will?
- Explore alternative funding sources – tolls, congestion pricing,

People

- Support your local university
  - Get to know the dean of engineering
  - Understand the changed role of research at universities
- Support and participate in mentoring programs
- Support summer jobs for students

Materials/planning, design & operations

- Think sustainability on all phases of project planning, design, construction and operations
- Many actions are well known for the preparation and operation of transportation services
  - Provide transportation choices – freight, transit, pedestrian, bicycle, ride sharing, pricing and policy.
  - Design for maintenance and flexibility
  - Consider the role of transportation in land use
- Move towards Leed certification for transportation projects.

Energy - 1

- The most difficult issue, especially in the short term
- Needto provide time for the implementation and impact of long term actions
- Beyond the realm of transportation engineers
- Contingency planning is essential
  - how to allocate scarce resources.
  - Must plan for the crisis in advance because there is no time to plan for it when it does actually happen.
  - Goal: To increase the ability to respond to an energy shortfall through an adjustment of demand without causing severe problems for households, or the economy.

Energy -2

- No easy long term solution, a combination of thousands of actions
  - Price increases
  - Conservation
  - Alternative Fuels
  - Increased efficiency
  - New sources
  - Economic adjustments

Conclusions -1

(presentation posted @http://www4.uwm.edu/cuts/ite09.pdf)

- The current system is not sustainable
- We need to understand system dynamics and equilibrium
- Transportation finance will be radically affected by future revenue declines, cost increases and other factors
- Education of future professionals in transportation is in jeopardy.
- There are many know actions that can improve the sustainability of transportation facilities and operations

Conclusions -2

(presentation posted @http://www4.uwm.edu/cuts/ite09.pdf)

- Energy issues will dominate the future of transportation and the economy
- Failure to act early will lead to more severe consequences
- Contingency planning is essential
- To do project planning, development or operations without a thorough knowledge of future situations is a waste of time
- Become knowledgeable about the issue

And Finally,

- For a good time see: http://www4.uwm.edu/cuts/signs/

Web sites

- http://www.uwm.edu/Dept/CUTS/ce790/trbsus.pdf
- http://www.uwm.edu/Dept/CUTS//2050/energy05.pdf
- http://www.uwm.edu/Dept/CUTS/ce790/sustpp.pdf
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