Thriving in the Post-Petroleum Era

3 Keys

Thriving in the Post-Petroleum Era

National Economic Schedule

2014 2020 2050

Climb out of recession
Restructure US economy
Planning horizon
Chaffee (C/E) 7

small differences
big changes

3 Keys

1

Knowledge

Petroleum Dependency

How petroleum is used in the US

Sources of energy for transportation in the US

EIA, 2008

EIA, 2008

EIA, 2008

29%
71%
20%
80%
55%
45%
5%
95%
other
Our transportation systems are almost entirely dependent on oil.

Where our oil comes from:
- 33% domestic
- 67% imported

2008 US Net Petroleum Trade Deficit: $300 B

Our transportation systems are almost entirely dependent on oil (imported).

"Peak Oil" is about price, not supply.

The Original Hubbert Curve

The oil is not gone...
...but the cheap oil is gone.

Petroleum Demand by World Region


India & China will double their demand for petroleum by 2030.
Those were the days!

1920
207,000 feet
BP's Thunder Horse Field

Source: Energy Information Administration

Production Cost – Sources of Oil

<table>
<thead>
<tr>
<th>Source</th>
<th>Production Cost Per Barrel of Oil - 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fields</td>
<td></td>
</tr>
<tr>
<td>Oil Shale</td>
<td></td>
</tr>
<tr>
<td>Lignite</td>
<td></td>
</tr>
<tr>
<td>Synfuel</td>
<td></td>
</tr>
<tr>
<td>Tar Sands/Heavy Oil</td>
<td></td>
</tr>
<tr>
<td>Enhanced Recovery</td>
<td></td>
</tr>
<tr>
<td>Conventional Oil</td>
<td></td>
</tr>
</tbody>
</table>

Source: Brandt & Farrell, UC Berkeley

energy prices now control our economic growth

Source: Energy Pathways for the California Economy, UC Berkeley, June 2009

We have used cheap energy to drive economic growth

Volatile Gas Prices

Source: Energy Information Administration
Oil prices rise, economy slows down.

Oil prices drop, economy rebounds.

"playing ping pong on a train"

Rate of economic growth

EIA Summer Fuels Outlook

<table>
<thead>
<tr>
<th></th>
<th>Crude Oil</th>
<th>Gasoline</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$80/barrel</td>
<td>$3.00/gallon</td>
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</tbody>
</table>

Potential Reduction in Petroleum Consumption Through Technology

World's Two Largest Companies

PetroChina $328 b

Exxon Mobile $315 b

Based on market capitalization on 3/23/10

Maybe technology will save us?

Electric cars have a role to play, but...

...will be expensive and...

...will create energy demand issues.

Total Motor Vehicles in Service in US in 2010 250,000,000

Total Electric Autos in Service by End of 2012 100,000

Technology will not save the day
We have not “run out of” oil because we ran out of stones.

The oil is not gone... but the cheap oil is gone.

US travel behavior is already changing...
Population & VMT

United States: Annual Rate of Change in VMT

United States: VMT per Capita

Colorado: VMT per Capita

Colorado: VMT per Month: 2008 & 2009

Daily Per Capita Travel

Daily Miles of Travel Per Capita

Annual Sales: New Motor Vehicles

Source: 2001 NHTS
Family/Personal
Commuting
Social/Recreational
Church/School
Other

Commute Trips

Discretionary Trips

Source: NHTS: Vehicle Miles Traveled Per Capita: Annualized and Realized Household Purse

Source: Annual Sales of Motor Vehicles

Source: Bureau of Transportation Statistics
Other economic sectors

Aviation is entirely dependent on petroleum

Oil Prices & Transpacific Shipping
(China – North America)

<table>
<thead>
<tr>
<th>Oil Price</th>
<th>Daily Cargo Ship Fuel Cost</th>
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</thead>
<tbody>
<tr>
<td>$30/barrel</td>
<td>$9,500</td>
</tr>
<tr>
<td>$100/barrel</td>
<td>$31,700</td>
</tr>
<tr>
<td>$150/barrel</td>
<td>$47,500</td>
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</table>

Oil Prices are Affecting Trade Balances

Ports of Los Angeles and Long Beach

Colorado Agriculture

Oil Prices & Fuel Cost as % of Freight Value

- $30/barrel: 2%
- $100/barrel: 8%
- $150/barrel: 13%

2

Strategy

Community & Regional Development

Land Use/Growth Management

Compact Cities & Towns

Mixed Use

Urban Design
where matters

“location efficiency”

Location efficiency:
complete neighborhoods + regional access

Regional Accessibility

Place Types
* from EPA/Caltrans work

Complete, Accessible
- Urban centers
- Core neighborhoods
- Walkable places
- Good public health
- Good transit
- Good access to jobs
- Low oil dependency
- High housing costs

Incomplete, Accessible
- First-tier suburbs
- Connected sprawl
- Few walkable places
- Fair public health
- Fair to good transit
- Good access to jobs
- Higher housing costs

Incomplete, Low Accessibility
- Fringe & exurban sprawl
- High oil dependency
- Tight household budgets
- Mortgage foreclosures
- Few walkable places
- Poor public health
- Poor access to jobs
- Little or no transit
**Household Economics**

<table>
<thead>
<tr>
<th>Available for:</th>
<th>Food</th>
<th>Health</th>
<th>Education</th>
<th>Consumer Expenditures</th>
<th>Recreation</th>
<th>Savings</th>
</tr>
</thead>
</table>

**Necessary for: Housing & Transportation**

- Food
- Health care
- Education
- Consumer expenditures
- Recreation
- Savings

**Share of Family Income Spent on Housing & Transportation**

<table>
<thead>
<tr>
<th>Family Income = $35,000 - $50,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central City</td>
</tr>
<tr>
<td>39%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Family Income = $20,000 - $35,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central City</td>
</tr>
<tr>
<td>54%</td>
</tr>
</tbody>
</table>

**Impact on Local Economies**

**How much household income is left for:**

<table>
<thead>
<tr>
<th>Food</th>
<th>Health Care</th>
<th>Education</th>
<th>Shopping</th>
<th>Recreation</th>
<th>Savings</th>
</tr>
</thead>
</table>

- **FOOD**: cheaper, less nutritious foods
- **HEALTH CARE**: less insurance, less preventive care
- **EDUCATION**: less higher education
- **SHOPPING**: lower sales tax receipts
- **RECREATION**: less sport activity, less exercise
- **SAVINGS**: lower savings rate, higher cost of capital

**Housing Markets are Reacting**

- Starter homes
- Workforce homes
- Luxury homes
- Second homes

**US Population**

- 2005: 295 M
- 2030: 364 M + 23%
- 2050: 392 M + 33%

**Population Growth by States, 1990s**

- Data Source: US Census Bureau, 1990

**Source:**

- A Heavy Load, Center for Neighborhood Technology
US Households

- 1960: 52%, 35%, 26%
- 2000: 40%, 61%, 29%
- 2040: 50%, 35%, 15%

Source: Dr. Arthur Nelson, University of Utah

US Households - % of Growth

- 2000-2040: 46%

Source: Dr. Arthur Nelson, University of Utah

US Dwelling Units

- 2003 Supply: 27, 17, 5
- 2025 Market: 51, 48, 7

Source: Dr. Arthur Nelson, University of Utah, JAPA

US Dwelling Units - % of Growth

- 2003-2025: 86%

Source: Dr. Arthur Nelson, University of Utah

US Households near transit

- 2000: 33%
- 2010: 50%
- 2020: 74%

Source: National Association of Realtors & SGA

Effect of location on housing value

- Los Angeles: region close-in - 10%, region distant - 11%
- Chicago: region close-in - 4%, region distant - 5%
- Pittsburgh: region close-in + 2%, region distant - 5%

Source: change in home values 1st quarter 2006 - 4th quarter 2007
effect of location on housing value

  - Region close: -1% to +1%
  - Distant: -5%

  - Region close: -13% to +3%
  - Distant: -5%

this is beginning to affect developers and housing starts

Share of New Housing Starts by Regional Location – Denver Region

- 1990-95: 100%
- 2003-08: 21%
- 2008: 32%

Share of New Housing Starts by Regional Location – Denver Region

Walkability and House Value*

<table>
<thead>
<tr>
<th>City</th>
<th>Walkability Premium</th>
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<tbody>
<tr>
<td>Austin, TX</td>
<td>$54,371</td>
</tr>
<tr>
<td>Dallas, TX</td>
<td>$54,278</td>
</tr>
<tr>
<td>Fresno, CA</td>
<td>$57,427</td>
</tr>
<tr>
<td>Phoenix, AZ</td>
<td>$51,689</td>
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<tr>
<td>Sacramento, CA</td>
<td>$54,345</td>
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<tr>
<td>San Francisco, CA</td>
<td>$52,637</td>
</tr>
<tr>
<td>Seattle, WA</td>
<td>$53,799</td>
</tr>
<tr>
<td>Tucson, AZ</td>
<td>$51,641</td>
</tr>
</tbody>
</table>

* difference in house value: citywide median WalkScore compared to 75 percentile and above

Walkable
- mixed-use
- transit-served
- urbanism

the complete neighborhood
- ¼ mile radius
- 160–200 acres
- schools
- local retail
- services
- parks
- diverse housing
The complete neighborhood:
- stable
- increasing value
- less VMT/capita
- in demand
- millennials

Walkable, mixed-use urbanism will be the primary market for new housing.

Walkable, mixed-use urbanism — housing stock available in 2010
- 5%

Walkable, mixed-use urbanism — housing demand to 2040
- 33%

Seniors and millennials:
- Two groups, same housing market: mixed-use, transit-served, walkable neighborhoods.

Aging of the US population:

- % over 65
- % over 50

Senior mobility:
- "Universal mobility"

AARP: a livable community has...
- Affordable & appropriate housing
- Supportive community features & services
- Adequate mobility options
- Which facilitate personal independence & the engagement of residents in civic and social life.

AARP livable communities model:
- Supportive community features & services
- Adequate mobility options
4 essentials: senior mobility
- land use mix
- pedestrian supportive environment
- connected street network
- high frequency transit service

supportive community features & services
1. active living
2. third places
3. convenience retail
4. provisions & services
5. family
6. shopping
7. medical
8. cultural

1. active living
- pedestrian-oriented environments
- trails, parks and open space
- gyms and exercise facilities

2. third places
- coffee shops, cafes
- bookstores, libraries
- churches
- bars
- plazas, parks
- senior centers

3. convenience retail
- corner market
- convenience store

4. provisions & services
- grocery
- bank
- cleaners
5. family
- grandchildren
- other family

6. shopping
- hardware
- clothing
- book store
- optical
- electronics

7. medical
- clinics, doctors
- hospitals
- pharmacy
- physical therapy
- opticians
- other specialists

8. cultural
- theater
- movie theater
- museums
- symphony
- art gallery
- restaurants

<table>
<thead>
<tr>
<th>destinations</th>
<th>daily</th>
<th>weekly</th>
<th>monthly</th>
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<tbody>
<tr>
<td>1. active living</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. third places</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3. convenience</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>4. provisions</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>5. family</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. shopping</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. medical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. cultural</td>
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neighborhood completeness

Portland "20-minute neighborhood"
should be within a short walk
4 essentials: senior mobility

- land use mix
- pedestrian supportive environment
- connected street network
- high frequency transit service

Windsor, CO – Old Town

Windsor, CO – after 1990

Good connectivity expands the range of walking trips, increasing pedestrian activity

Optimum block size for efficient traffic flow

- 330' to 528'

Common connectivity standards

- intersections/square mile (min 200)
- maximum block perimeter (1400' – 1800')
- block length (330' – 528')
- links/nodes
Western Colorado’s cities and larger towns could achieve walkable, complete neighborhoods...

...but will struggle to provide regional accessibility

Measuring & Reporting Performance
✓ Vehicle miles of travel (VMT)
✓ VMT/capita
✓ VMT/job
✓ VMT/$1 retail sales

Data Sources:
- Traffic counts
- Travel diaries

✓ Mode share

Data Sources:
- Travel diaries
- Travel surveys

✓ Land Use Mix

Data Sources:
- Mix index
- Walk score

✓ Multimodal level of service criteria

 ✓ Pedestrian
 ✓ Bicycle
 ✓ Transit

Data Sources:
- Local observation GIS layer

Fort Collins Multimodal LOS Standards:

Pedestrian

LOS Criteria:
- Directness
- Continuity
- Grade Crossings
- Visual Interest & Amenities
- Security

Location Areas:
- Pedestrian District
- Activity Center/Corridor
- Transit Corridor
- School Walk Area
- Other

Destination Areas:
- Recreation Sites
- Residential Areas
- Institutional Sites
- Office Buildings
- Commercial Sites

Fort Collins Multimodal LOS Standards:

Bicycle

Based on Connectivity to bike facilities in connecting corridors

Bike Corridors may contain 1 of 3 types of facilities:
- On-street lanes
- Off-street paths
- On-street routes

Fort Collins Multimodal LOS Standards:

Transit

Based on Route characteristics & land use characteristics

Service Level Standards:
- Hours of service
- Frequency of service
- Travel time factor
- Peak load factor

Service Level Standards:
- Mixed Use Centers & Commercial Centers
- remainder of service area

“accountability”
1. Knowledge

2. Strategy

3. Credibility

Petroleum Dependency

Community & Regional Development

National Economic Schedule