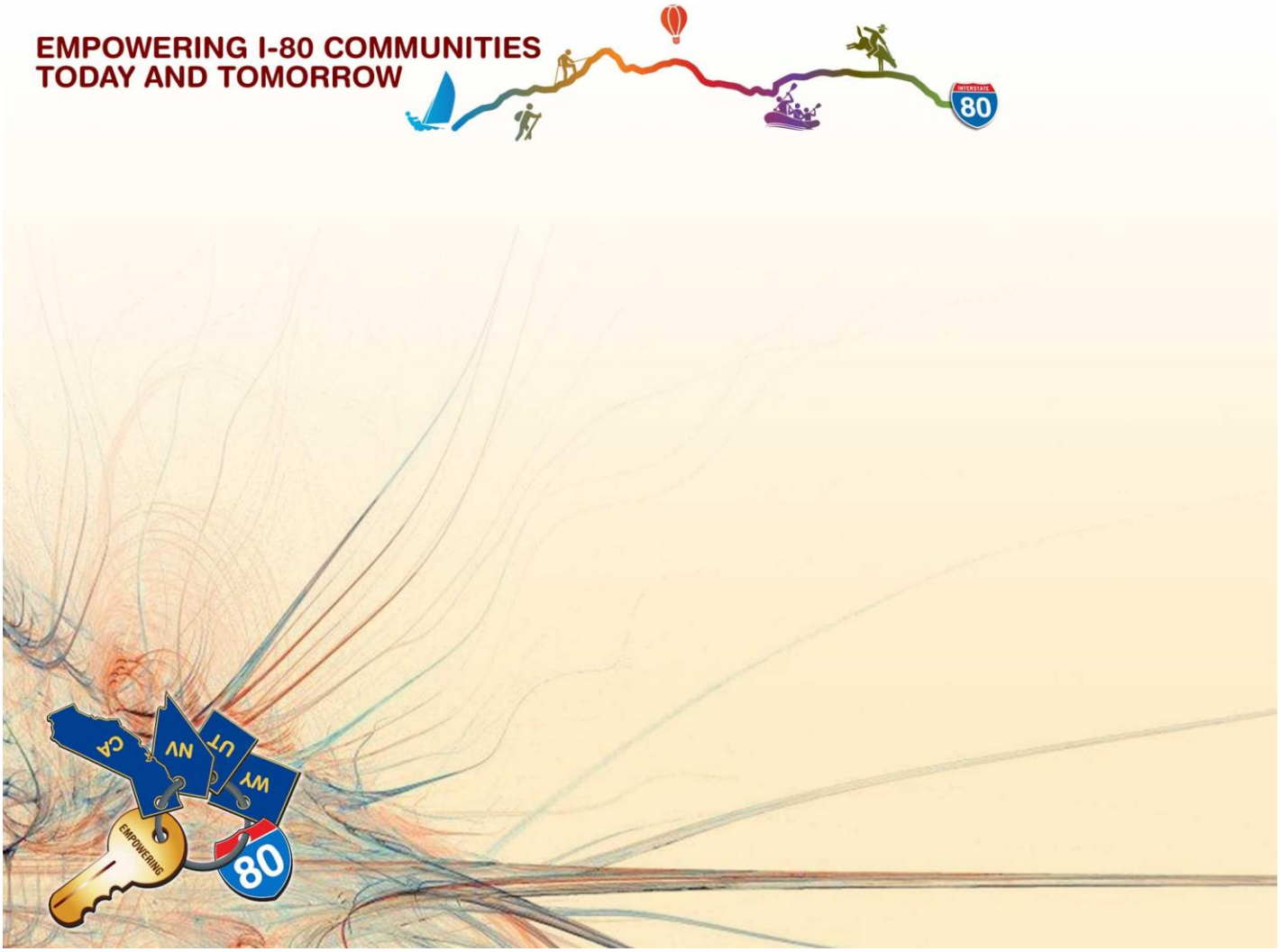
EMPOWERING I-80 COMMUNITIES
TODAY AND TOMORROW




# A11. Energy Infrastructure Working Group

EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

# I-80 CSMP Energy Infrastructure Working Group

## Meeting 1 Attendance Record



The following Working Group members have RSVPed to date our first meeting. The meeting agenda is at:

http://www.i80vision.org/topic-summary/energy/infrastucture/meetings/meeting1

| RSVP | Name | Organization | Email | Headshot |
|---|---|---|---|---|
| X | Greg Scott | Wasatch Front Regional Council | gscott@wfrc.org | |
| X | Thomas Smith | WashDOT | smithtm@wsdot.wa.gov | |
| | Jeff Doyle | WashDOT | doylej@wsdot.wa.gov | |
| | Steve Merrill | NDOT | smerrill@dot.state.nv.us | |
| X | Rick Helman | Caltrans D3 | richard_helman@dot.ca.gov | |
| | Deborah Schrimmer | SACOG | dschrimmer@sacog.org | |
| | | | | |
| | | | | |
| | | | | |
| | Manju Kumar (Co Chair) | NDOT | richard_helman@dot.ca.gov | |
| X | Perry Gross (Chair) | Atkins | Perry.gross@atkinsglobal.com |  |

The list on the following page will allow group members to Email all group members during the conference call if the need arises.


**Email All** (Copy and Paste into the To: section of Outlook)

gscott@wfrc.org; smithtm@wsdot.wa.gov; doylej@wsdot.wa.gov; smerrill@dot.state.nv.us; richard_helman@dot.ca.gov; dschrimmer@sacog.org ; mkumar@dot.state.nv.us; perry.gross@atkinsglobal.com

**Disclaimer**: Please excuse miss spellings, typos, and the picture of my mug. The photographer had little to work with as the output from my typing skills will attest.


| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Organizing the Group | | |
| **Date and time:** | January 29, 2013 2:00 P.M. PCST | **Meeting no:** | 1 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | *Tom Smith (WashDOT)*<br>*Steve Merrill (NDOT)*<br>*Rick Helman (Caltrans D3)*<br>*Coy Peacock (NDOT)* | *Andrea Napoli (NDOT)*<br>*Kristine Absher (Atkins)*<br>*Danja Petro (Atkins)*<br>*Perry Gross (Atkins)* | |

| ITEM | DESCRIPTION |
|---|---|
| 1 | Roll call for RSVP and other attendees |
| 2 | Presentation of I-80 CSMP study background<br>*The two overarching aims of the I-80 CSMP are: to prioritize existing corridor significant programs, projects, and initiatives for early action; and generate a future vision of corridor communities and strategies for how the I-80 corridor can support them. Ultimately, this study should generate the system necessary to implement the strategies to achieve the vision. The initial work with the Study Task Forces identified 14 topics for working group to explore of which this working group is one.* |
| 3 | Establish ground rules for how to best engage in conference calls and other group activities (discussion of typical group ground rules)<br>*Perry reviewed the basic elements of classic dialogues as the basis for the group's ground rules. These will be combined with suggestions that individuals identify themselves when they begin to speak and respect group member's time commitments. We must also accommodate members who work in cubicles.* |
| 4 | Review the stakeholder primer that establishes how to use the web site and RSS feeds (presentation/discussion)<br>*Attendees were directed to www.i80vision.org to review some of the Study web site functionality meant to facilitate group dialogue.* |
| 5 | Next steps including identification of additional working group members (discussion)<br>*Attendees provided thoughts for other individuals we should recruit into our dialogue and on how to improve future conference call meetings.* |
| 6 | Adjourn<br>*The meeting adjourned at 2:55 PM Pacific time.* |

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Working Groups and Task Forces; Discussion Topics; Initial Goals, Objectives, and Deliverables | | |
| **Date and time:** | January 29, 2013 2:00 P.M. PCST | **Meeting no:** | 2 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | *Greg Scott (WFRC)*<br>*Steve Merrill (NDOT)*<br>*Mark Wingate (WyDOT)*<br>*Mike Lawson (Atkins* | *Stan Hanel (Nevada Electric Vehicle Accelerator)*<br>*Coy Peacock (NDOT)*<br>*Perry Gross (Atkins)* | |

| ITEM | DESCRIPTION |
|---|---|
| 1 | Roll call for RSVP and other attendees |
| 2 | Review the purpose of Working Groups to better inform the larger Task Forces about their topic and subtopics (presentation)<br>*Perry provided a brief explanation of how the initial work among the study Task Forces initiated the Working Groups to explore in depth specific corridor significant topics. The organization of the working groups uses the study web site to facilitate the group's dialogue. Once the group has charted a course, we will inform the Task Forces and refine our work. Additionally, we will take on the work of exploring the implications of liveability principles for the corridor communities.* |
| 3 | Identify an initial list of subtopics for the Working Group to explore (brainstorming).<br>*The Working Group went to our homepage and began refining our list of sub topics. Stan provided a review of Nevada's electric vehicle charging program and a wonderful explanation of charging technologies and challenges moving forward (Beta v. VHS). Greg highlighted Utah's initiatives with compressed natural gas. Mark indicated Wyoming was in early stages of conversation. Mike suggested we consider the impacts of energy sources with revenue generating initiatives. All agreed that policy plays an important role.* |
| 4 | Begin establishing goals and objective for the Working Group including deliverable that makes sense to the group. Additional work on goals, objectives, and deliverables will be done through surveys and reported in meeting 3 (brainstorming).<br>*The group discussed avenues for documenting our work and providing the means for future implementation of the group's initiatives. Position papers, information repository, among other rides were suggested. Coy emphasized the need for the group to provide a level of leadership on many of the study topics. Steve call for the group to adopt a vision of promoting an energy independent corridor that capitalizes on local energy resources in beneficial ways. This approach is supported by the group and Coy charged Perry with providing the group a "head start" on a vision for the group to consider. Perry will reshape the Meeting 3 agenda to accommodate the results of this meeting with work the group needs to complete and present to the Task Forces.* |
| 5 | Next steps including identifying additional working group members<br>*Stan identified University colleagues to recruit into our dialogue. Coy pointed out that a powerful vision for the group will help with recruiting. A review of positive and things to change for future meetings highlighted the value of spending some time in each meeting to exchange information important to each of the group members similar to Stan's explanation of EV changing systems. This will be included in future meeting agendas.* |
| 6 | Adjourn<br>*The group adjourned at 2:55 pm Pacific.* |

**Group:** I80 CSMP Energy Infrastructure Working Group

EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

| | | | |
|---|---|---|---|
| **Subject:** | Review Draft Goals and Objectives; Additional Information; Livability; Task Force Presentation | | |
| **Date and time:** | February 12, 2013 2:00 P.M. PCST | **Meeting no:** | 3 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | *Tom Smith (WSDOT)*<br>*Steve Merrill (NDOT)*<br>*Rick Helman (Caltrans D3)*<br>*Coy Peacock (NDOT)* | *Stan Hanel (Nevada Electric Vehicle Accelerator)*<br>*Andrea Napoli (NDOT)*<br>*Perry Gross (Atkins)* | |

**Agenda**

| ITEM | DESCRIPTION |
|---|---|
| 1 | Chat or Mute for individual meeting organization |
| 2 | Roll call for RSVP and other attendees<br>*Attendees are noted above.* |
| 3 | Review and refine the draft goal and vision statement and discuss their implication for the group's work<br>*The Group collectively endorsed the goal and vision statements with minor modifications. These statements are to be integrated into the Group's home page.* |
| 4 | Identify additional sources of information (list of initial information needs to be developed) (brainstorm)<br>*This brainstorming session revealed the many and interrelated topics surrounding alternative energy and the future needs of infrastructure. Perry suggested that one effective way to explore these complex and uncertain futures would be to employ "Art of the Long View" type of scenario planning advocated by Peter Schwartz. After a brief explanation of this approach, the group agreed that Perry should provide the Group additional information for their consideration to employ this approach for their dialogue.* |
| 5 | Introduce the liveability self assessment concept and proposed process for connecting topics to liveability principles (presentation/discussion)<br>*Perry provided a brief status report on how livability principles were going to be integrated into study dialogues through the use of a livability self-assessment tool.* |
| 6 | Develop a brief presentation for the Task Forces to explain what the group plan to accomplish (discussion)<br>*Group members decided to present the goal and vision statements to the Joint Task Forces during the study status update conference call. This may also include a discussion of potentiall undertaking a scenario planning effort.* |
| 7 | Adjourn |



| | |
|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group |

| | | | |
|---|---|---|---|
| **Subject:** | Refine Working Group planned efforts | | |
| **Date and time:** | February 26, 2013 2:00 P.M. PCST | **Meeting no:** | 4 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | *Tom Smith (WSDOT)*<br>*Steve Merrill (NDOT)*<br>*Rick Helman (Caltrans D3)*<br>*Coy Peacock (NDOT)* | *Stan Hanel (Nevada Electric Vehicle Accelerator)*<br>*Andrea Napoli (NDOT)*<br>*Perry Gross (Atkins)* | |

| ITEM | DESCRIPTION |
|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting<br>*The group exchanged general information about individual ongoing work.* |
| 2 | Roll call for RSVP and other attendees<br>*RSVPs responded as noted above.* |
| 3 | Brief summary of the group's goal and vision<br>*Perry read the draft goal statement and asked for group feedback. The group had general agreement with the content and implications of the statement and the strengths highlighted by Perry in the presentation. Interestingly, mobility, transport, and transportation were discussed as suggesting slightly different perspectives for the group's work. Perry read the draft vision statement and some initial thoughts that highlight what the statement captures. Stan noted that we should emphasize the long term commitment in a positive frame with additional work to capture that requirement. The group also highlighted the concept of nonlinearity implied by the vision statement. Perry offered an explanation based on nonlinear mathematics with the example of achieving unexpectedly large results from a relatively small initiative. Tom noted that nonlinear also implied the need to work simultaneously across the entire corridor as well as all three physical dimensions across the corridor. Elements of system theory are relevant.* |
| 4 | Discussion of scenario planning and strategies for employing the process to energy infrastructure within the I-80 corridor<br>*Perry reviewed highlights of Peter Schwartz's approach scenario planning. Stan noted that the focus on generating multiple "story" narratives would be useful for effectively and efficiently conveying the work of the group to broader audiences. One example is tying the technical implications of numeric data into a context that reveals their broader social implications. The group plans to generate three scenarios. Perry will provide the group an outline of how we will undertake scenario planning.* |
| 5 | Refine task force presentation based on previous meeting discussions<br>*Perry will develop for group approval the outline of the scenario planning process, incorporate group refinements for the goal and vision statement, and email to the group for comment.* |
| 6 | Next steps including identifying additional working group members<br>*Coy indentified the Clean Cities Coalition with Department of Energy and other initiatives within the energy community including state level departments as valuable group members. The diversity of this group will directly influence the quality, credibility, and ultimate of the work achieved.* |
| 7 | Adjourn<br>*Meeting closed at 2:46pm PST/3:46pm MST.* |



| | |
|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group |
| **Subject:** | Organize Scenario Planning |

EMPOWERING I-80 COMMUNITIES
TODAY AND TOMORROW

| | | | |
|---|---|---|---|
| **Date and time:** | April 23, 2013 2:00 P.M. PCST | **Meeting no:** | 5 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| Attendees: | *Steve Merrill (NDOT)*<br>*Rick Helman (Caltrans D3)* | *Perry Gross (Atkins)*<br>*Coy Peacock (NDOT)* | |

| ITEM | DESCRIPTION |
|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting |
| 2 | Roll call for RSVP and other attendees<br>*Attendees are noted above.* |
| 3 | Quick discussion to confirm first Scenario Planning meeting at 2pm Pacific 3pm Mountain April 30, 2013.<br>*Attendees agreed to begin the scenario planning with a conference call on Tuesday Arpil 30th. Perry indicated he would begin working on a website for the group to use to generate the scenarios. (ongoing)* |
| 4 | Adjourn |

EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

# I-80 CSMP Energy Infrastructure Working Group

## Meeting 4 Attendance Record



The following Working Group members have RSVPed to date our meeting. The meeting agenda is at:

https://sites.google.com/site/i80csmp/topic-summary/energy-infrastucture/meetings/meeting4

| RSVP | Name | Organization | Email | Headshot |
|---|---|---|---|---|
| X | Greg Scott | Wasatch Front Regional Council | gscott@wfrc.org | |
| X | Thomas Smith | WashDOT | smithtm@wsdot.wa.gov | |
| - | Jeff Doyle | WashDOT | doylej@wsdot.wa.gov | |
| X | Steve Merrill | NDOT | smerrill@dot.state.nv.us | |
| - | Mark Wingate | WyDOT | mark.wingate@wyo.gov | |
| X | Rick Helman | Caltrans D3 | richard_helman@dot.ca.gov | |
| X | Stan Hanel | Nevada Electric Vehicle Accelerator | stanhanel@aol.com |  |
| - | Chris Melville | City of West Wendover | cmelville@westwendovercity.com | |
| T | Andrea Napoli | NDOT | anapoli@dot.state.nv.us | |
| X | Coy Peacock | NDOT | cpeacock@dot.state.nv.us | |
| X | Manju Kumar (Co Chair) | NDOT | mkumar@dot.state.nv.us | |
| T | Mike Lawson | Atkins | Michael.Lawson@atkinsglobal.com | |

| | | | | |
|---|---|---|---|---|
| X | Perry Gross (Chair) | Atkins | Perry.gross@atkinsglobal.com |  |



The list below will allow group members to Email all group members during the conference call if the need arises.

**Email All** (Copy and Paste into the To: section of Outlook)

gscott@wfrc.org; smithtm@wsdot.wa.gov; doylej@wsdot.wa.gov; smerrill@dot.state.nv.us; richard_helman@dot.ca.gov; mkumar@dot.state.nv.us; stanhanel@aol.com ; anapoli@dot.state.nv.us; cpeacock@dot.state.nv.us; mark.wingate@wyo.gov; cmelville@westwendovercity.com; perry.gross@atkinsglobal.com; Michael.Lawson@atkinsglobal.com

EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Driving Forces and Predetermined Elements | | |
| **Date and time:** | April 30, 2013 2:00 P.M. PCST | **Meeting no:** | 6 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | *Greg Scott (WFRC)*<br>*Steve Merrill (NDOT)*<br>*Rick Helman (Caltrans D3)*<br>*Tom Smith (WSDOT)*<br>*Manju Kumar (NDOT)* | *Stan Hanel (Nevada Electric Vehicle Accelerator)*<br>*Perry Gross (Atkins)*<br>*Coy Peacock (NDOT)* | |

**Agenda**

| ITEM | DESCRIPTION |
|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting |
| 2 | Roll call for RSVP and other attendees<br><br>*See above for attendees.* |
| 3 | Review survey results for information sources and interesting plot lines.<br><br>*Attendees indicated they were still evaluating the survey results and would consider them during future meetings.* |
| 4 | Each group member identify one "**driving force**": social influences, technological factors, economic and political influences, and environmental implications<br><br>*Perry read through each of the four compiled lists of driving factors one at a time. Once a list was read aloud the group provided their individual first impression. These impressions and subsequent discussions identified several driving forces that were summarized for future group consideration.* |
| 5 | Each group member identify one "**predetermined elements**": slow-changing phenomena, constraining factors, factors in the pipeline, inevitable collisions.<br><br>*This discussion was tabled until the group's next discussion.* |
| 6 | Next steps including identifying additional working group members.<br><br>*The group agreed to having the next meeting on Tuesday, May 21st at 2pm Pacific/3pm Mountain.* |
| 7 | Adjourn<br><br>*This productive and insightful discussion adjourned at 2:55pm Pacific/3:55pm Mountain.* |


| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Driving Forces and Predetermined Elements | | |
| **Date and time:** | May 21, 2013 2:00 P.M. PCST | **Meeting no:** | 7 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | *Rick Helman (Caltrans D3)*<br>*Tom Smith (WSDOT)*<br>*Manju Kumar (NDOT)* | *Stan Hanel (Nevada Electric Vehicle Accelerator)*<br>*Perry Gross (Atkins)*<br>*Coy Peacock (NDOT)* | |

**Agenda**

| ITEM | DESCRIPTION |
|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting |
| 2 | Roll call for RSVP and other attendees<br><br>*See above for meeting attendees.* |
| 3 | Review "**driving force**": summary from Meeting 6<br><br>*Perry read aloud his six driving forces summary statement. Manju inquired what the relationship between these six statements and the original extensive lists organized into social, influences, technological factors, environmental implications, economic and political influences. Perry indicated these six statements attempted to reflect how the group had connected the broad list of driving forces into more comprehensive statements with specific implications. The group concurred and requested a brief two or three word descriptive title be developed to capture the concepts. Tom and the group provided initial thoughts and Perry agree to compile a draft form for the driving forces.* |
| 4 | Each group member identify one "**predetermined elements**": slow-changing phenomena, constraining factors, factors in the pipeline, inevitable collisions<br><br>*The group turned to predetermined elements with Perry reading aloud the statements for slow changing phenomena. As the group discussed the individual and collective statements the concept of thresholds began to emerge. As Tom noted, the broad public's eventual acceptance of mobile computing devices has reduced the desk top computer market drastically. In short, thresholds for slow changing phenomena often reach thresholds leading to cascading events. Perry suggested that perhaps one way to assess this concept was a qualitative assessment of high, medium, and low probability for thresholds. This led the remanding discussion leading to several insights about predetermined elements in the complex and shifting alternative energy environment. Perry capture this discussion and will compile statements similar to the driving forces statements for the group's consideration. It is interesting to note one emerging perspective may be summarized as "the capital society verses the great society".* |
| 5 | Next steps including identifying additional working group members<br><br>*See above for meeting attendees.* |

6 Adjourn

EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Driving Forces and Predetermined Elements | | |
| **Date and time:** | June 4, 2013 2:00 P.M. PCST | **Meeting no:** | 8 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | *Greg Scott (WFRC)*<br>*Steve Merrill (NDOT)*<br>*Rick Helman (Caltrans D3)*<br>*Tom Smith (WSDOT)*<br>*Manju Kumar (NDOT)* | *Stan Hanel (Nevada Electric Vehicle Accelerator)*<br>*Perry Gross (Atkins)*<br>*Coy Peacock (NDOT)* | |

**Agenda**

| ITEM | DESCRIPTION |
|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting |
| 2 | Roll call for RSVP and other attendees<br><br>*See above for attendees.* |
| 3 | Review survey results for information sources and interesting plot lines.<br><br>*Attendees indicated they were still evaluating the survey results and would consider them during future meetings.* |
| 4 | Each group member identify one "**driving force**": social influences, technological factors, economic and political influences, and environmental implications<br><br>*Perry read through each of the four compiled lists of driving factors one at a time. Once a list was read aloud the group provided their individual first impression. These impressions and subsequent discussions identified several driving forces that were summarized for future group consideration.* |
| 5 | Each group member identify one "**predetermined elements**": slow-changing phenomena, constraining factors, factors in the pipeline, inevitable collisions.<br><br>*This discussion was tabled until the group's next discussion.* |
| 6 | Next steps including identifying additional working group members.<br><br>*The group agreed to having the next meeting on Tuesday, May 21st at 2pm Pacific/3pm Mountain.* |
| 7 | Adjourn<br><br>*This productive and insightful discussion adjourned at 2:55pm Pacific/3:55pm Mountain.* |

EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Driving Forces and Predetermined Elements | | |
| **Date and time:** | June 18, 2013 2:00 P.M. PCST | **Meeting no:** | 9 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | *Greg Scott (WFRC)*<br>*Steve Merrill (NDOT)*<br>*Rick Helman (Caltrans D3)*<br>*Tom Smith (WSDOT)*<br>*Manju Kumar (NDOT)* | *Stan Hanel (Nevada Electric Vehicle Accelerator)*<br>*Perry Gross (Atkins)*<br>*Coy Peacock (NDOT)* | |

**Agenda**

| ITEM | DESCRIPTION |
|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting |
| 2 | Roll call for RSVP and other attendees<br><br>*See above for attendees.* |
| 3 | Review survey results for information sources and interesting plot lines.<br><br>*Attendees indicated they were still evaluating the survey results and would consider them during future meetings.* |
| 4 | Each group member identify one "**driving force**": social influences, technological factors, economic and political influences, and environmental implications<br><br>*Perry read through each of the four compiled lists of driving factors one at a time. Once a list was read aloud the group provided their individual first impression. These impressions and subsequent discussions identified several driving forces that were summarized for future group consideration.* |
| 5 | Each group member identify one "**predetermined elements**": slow-changing phenomena, constraining factors, factors in the pipeline, inevitable collisions.<br><br>*This discussion was tabled until the group's next discussion.* |
| 6 | Next steps including identifying additional working group members.<br><br>*The group agreed to having the next meeting on Tuesday, May 21st at 2pm Pacific/3pm Mountain.* |
| 7 | Adjourn<br><br>*This productive and insightful discussion adjourned at 2:55pm Pacific/3:55pm Mountain.* |


# I-80 CSMP Energy Infrastructure Working Group

## Meeting Attendance Record

The following Working Group members have RSVPed to date our meeting. The meeting agenda is at:

http://www.i80vision.org/topic-summary/energyinfrastucture/meetings/july232013



| RSVP | Name | Organization | Email | Headshot |
|---|---|---|---|---|
| - | Greg Scott | Wasatch Front Regional Council | gscott@wfrc.org | |
| X | Thomas Smith | WashDOT | smithtm@wsdot.wa.gov | |
| - | Jeff Doyle | WashDOT | doylej@wsdot.wa.gov | |
| X | Steve Merrill | NDOT | smerrill@dot.state.nv.us | |
| X | Mark Wingate | WyDOT | mark.wingate@wyo.gov | |
| X | Gary Arnold | Caltrans D3 | gary.arnold@dot.ca.gov | |
| X | Stan Hanel | Nevada Electric Vehicle Accelerator | stanhanel@aol.com | |
| - | Chris Melville | City of West Wendover | cmelville@westwendovercity.com | |
| X | Coy Peacock | NDOT | cpeacock@dot.state.nv.us | |
| X | Manju Kumar (Co Chair) | NDOT | mkumar@dot.state.nv.us | |
| X | Mike Lawson | Atkins | MichaelLawson@atkinsglobal.com | |
| X | Laycee Kolkman | HDR | Laycee.Kolkman@hdrinc.com | |
| X | Shawn Frye | HDR | Shawn.Frye@hdrinc.com | |
| - | Rick Helman | Caltrans D3 | richard_helman@dot.ca.gov | |
| X | Perry Gross (Chair) | Atkins | Perry.gross@atkinsglobal.com | |


The list below will allow group members to Email all group members during the conference call if the need arises.

**Email All** (Copy and Paste into the To: section of Outlook)

gscott@wfrc.org; smithtm@wsdot.wa.gov; doylej@wsdot.wa.gov; smerrill@dot.state.nv.us; richard_helman@dot.ca.gov; mkumar@dot.state.nv.us; stanhanel@aol.com; cpeacock@dot.state.nv.us; mark.wingate@wyo.gov; cmelville@westwendovercity.com; perry.gross@atkinsglobal.com; Michael.Lawson@atkinsglobal.com; gary.arnold@dot.ca.gov; Shawn.Frye@hdrinc.com; Laycee.Kolkman@hdrinc.com

EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | GIS Tools and Scenario Plots | | |
| **Date and time:** | July 23, 2013 2:00 P.M. PCST | **Meeting no:** | 10 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | TBD | | |

**Agenda**

| ITEM | DESCRIPTION | TIME | RESPONSIBLE |
|---|---|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting | 2:00 | Perry/All |
| 2 | Roll call for RSVP and other attendees | 2:05 | Perry |
| 3 | What we are learning about GIS and Energy Infrastructure along I-80 | 2:10 | Shawn/All |
| 4 | Shaping our question in light of Shell's Energy Future scenarios – how did we do with our situational framework | 2:30 | Perry/All |
| 5 | Next steps – meeting logistics, task forces, and initiatives exploration | 2:55 | Perry/All |
| 6 | Adjourn | 3:00 | Perry/All |

EMPOWERING I-80 COMMUNITIES
TODAY AND TOMORROW

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | GIS Tools and Scenario Plots | | |
| **Date and time:** | August 6, 2013 2:00 P.M. PCST / 3:00 P.M. MST | **Meeting no:** | 11 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | TBD | | |

**Agenda**

| ITEM | DESCRIPTION | TIME | RESPONSIBLE |
|---|---|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting | 2:00 | Perry/All |
| 2 | Roll call for RSVP and other attendees | 2:05 | Perry |
| 3 | Get everyone logged into the webinar | 2:10 | Shawn/All |
| 4 | Engage in the GIS webinar | 2:15 | Shawn /All |
| 5 | Next steps – introduce draft scenario matrix for group consideration | 2:50 | Perry/All |
| 6 | Adjourn | 3:00 | Perry/All |

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | GIS Tools and Scenario Plots | | |
| **Date and time:** | August 20, 2013 2:00 P.M. PCST / 3:00 P.M. MST | **Meeting no:** | 12 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | TBD | | |

**Agenda**

| ITEM | DESCRIPTION | TIME | RESPONSIBLE |
|---|---|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting | 2:00 | Perry/All |
| 2 | Roll call for RSVP and other attendees | 2:05 | Perry |
| 3 | Quick thoughts on emerging ideas such as automated vehicles, supersonic tube travel among others | 2:10 | Shawn/All |
| 4 | Identifying scenario plots through favourite movies and books | 2:15 | Shawn /All |
| 5 | Next steps – Perry to provide a draft storyboard??? | 2:25 | Perry/All |
| 6 | Adjourn | 2:30 | Perry/All |

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Michener Draft Plot | | |
| **Date and time:** | September 3, 2013 2:00 P.M. PCST / 3:00 P.M. MST | **Meeting no:** | 13 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | TBD | | |

**Agenda**

| ITEM | DESCRIPTION | TIME | RESPONSIBLE |
|---|---|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting | 2:00 | Perry/All |
| 2 | Roll call for RSVP and other attendees | 2:05 | Perry |
| 3 | Review of Perry's scenario plot line based on James Michener's story telling style. | 2:10 | Perry/All |
| 4 | Next steps – GIS data elements | 2:25 | Perry/All |
| 6 | Adjourn | 2:30 | Perry/All |

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Scenario Plots and GIS | | |
| **Date and time:** | September 17, 2013 2:00 P.M. PCST / 3:00 P.M. MST | **Meeting no:** | 14 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | TBD | | |

**Agenda**

| ITEM | DESCRIPTION | TIME | RESPONSIBLE |
|---|---|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting | 2:00 | Perry/All |
| 2 | Roll call RSVPs and others | 2:05 | Perry/All |
| 3 | Review the “Michener” formula and four families with our situational framework | 2:10 | Perry/All |
| 4 | GIS data collection strategies | 2:30 | Perry/Shawn/All |
| 5 | Next steps – Perry to provide a draft storyboard??? | 2:40 | Perry/All |
| 6 | Adjourn | 2:45 | Perry/All |


# I-80 CSMP Energy Infrastructure Working Group

## Meeting Attendance Record



| RSVP | Name | Organization | Email | Headshot |
|---|---|---|---|---|
| | Greg Scott | Wasatch Front Regional Council | gscott@wfrc.org | |
| | Thomas Smith | WashDOT | smithtm@wsdot.wa.gov | |
| | Jeff Doyle | WashDOT | doylej@wsdot.wa.gov | |
| | Steve Merrill | NDOT | smerrill@dot.state.nv.us | |
| | Mark Wingate | WyDOT | mark.wingate@wyo.gov | |
| | Gary Arnold | Caltrans D3 | gary.arnold@dot.ca.gov | |
| | Stan Hanel | Nevada Electric Vehicle Accelerator | stanhanel@aol.com | |
| | Chris Melville | City of West Wendover | cmelville@westwendovercity.com | |
| | Coy Peacock | NDOT | cpeacock@dot.state.nv.us | |
| | Joseph Spencer | NDOT | JSpencer@dot.state.nv.us | |
| | Manju Kumar (Co Chair) | NDOT | mkumar@dot.state.nv.us | |
| | Mike Lawson | Atkins | Michael.Lawson@atkinsglobal.com | |
| | Laycee Kolkman | HDR | Laycee.Kolkman@hdrinc.com | |
| | Shawn Frye | HDR | Shawn.Frye@hdrinc.com | |
| | Rick Helman | Caltrans D3 | richard_helman@dot.ca.gov | |
| | Perry Gross (Chair) | Atkins | Perry.gross@atkinsglobal.com | |


The list below will allow group members to Email all group members during the conference call if the need arises.

**Email All** (Copy and Paste into the To: section of Outlook)

gscott@wfrc.org; smithtm@wsdot.wa.gov; doylej@wsdot.wa.gov; smerrill@dot.state.nv.us; mark.wingate@wyo.gov; gary.arnold@dot.ca.gov; mkumar@dot.state.nv.us; stanhanel@aol.com; cpeacock@dot.state.nv.us; cmelville@westwendovercity.com; perry.gross@atkinsglobal.com; Michael.Lawson@atkinsglobal.com; Shawn.Frye@hdrinc.com; Laycee.Kolkman@hdrinc.com; JSpencer@dot.state.nv.us; richard_helman@dot.ca.gov

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Scenario Plots and GIS | | |
| **Date and time:** | October 1, 2013 2:00 P.M. PCST / 3:00 P.M. MST | **Meeting no:** | 15 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | TBD | | |

**Agenda**

| ITEM | DESCRIPTION | TIME | RESPONSIBLE |
|---|---|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting | 2:00 | Perry/All |
| 2 | Roll call RSVPs and others | 2:05 | Perry/All |
| 3 | Acquiring GIS data elements – **production** (geothermal power plants, natural gas power plants, solar farms, hydro power plants, natural gas production fields, wind farms, and coal power plants – **distribution** (electric transmission lines, electric distribution lines, natural gas lines, electric substations, and natural gas tank storage) – **consumption** (existing alternative energy stations by type, truck stops, and gas stations) | 2:10 | Perry/Shawn/All |
| 4 | Review Perry's draft scenario plot lines combined with situation framework elements | 2:25 | Perry/All |
| 5 | Next steps – review meeting calendar for the holiday season | 2:40 | Perry/All |
| 6 | Adjourn | 2:45 | Perry/All |

EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | GIS Data Methodology and Review of Work Product Approval Process | | |
| **Date and time:** | October 15, 2013 2:00 P.M. PCST / 3:00 P.M. MST | **Meeting no:** | 16 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | Steve Merrill, NDOT<br>Stan Hanal, NEVA<br>John Burgess, NDOT<br>Laycee Kolkman, HDR | Coy Peacock, NDOT<br>Manju Kumar, NDOT<br>Shawn Frye, HDR<br>Perry Gross, Atkins | |

**Agenda**

| ITEM | DESCRIPTION | TIME | RESPONSIBLE |
|---|---|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting | 2:00 | Perry/All |
| 2 | Roll call RSVPs and others<br><br>*See above* | 2:05 | Perry/All |
| 3 | GIS data methodology including:<br>○ Data types such as point, polygon, or temporal,<br>*Shawn added line data and the notion that temporal data could use a slide bar to view information through time. It should be noted that tabular, database organized data is acceptable even lacking coordinate information.*<br>○ Data origination and/or maintenance,<br>○ Acquisition,<br>○ Static or dynamic (feeds),<br>*We have mostly static data and need to determine how it is to be updated moving forward. We have not purchased any data yet. Perry and Laycee asked Shawn if the data pop down menus could use a "tree" structure to better organize the many potential layers. Shawn indicated that there is some "tree" functionality and would investigate further.*<br>○ Web rerouting protocols,<br>*This item concerns providing URL links to original data sources. This will be done to allow GIS tool users to investigate more fully the implications of the data provided.*<br>○ Use caveats and/or disclaimers,<br>○ Updates and/or revisions,<br>*This discussion surfaced the notion of "watermarking" the web portal and the PDF document printing function. This would provide caveats and information about how current the information is per data item type. Shawn felt this was possible and would investigate further.* | 2:10 | Perry/Shawn/All |

| | | | |
|---|---|---|---|
| | ○ Integration with other Working Group data sets,<br>*This discussion reinforced the need for tree layouts for the data layer pop down menus.*<br>○ Use in value-added applications, and<br>*The future potential for developing smart phone apps using this web-based information is not precluded by the work we are doing now.*<br>○ Graphical user interface (GUI)<br>*The web portals interface had limited capacity for modification. Shawn would investigate how much we would be able to provide a distinct look and feel for the I-80 Stakeholder Network GIS tool.* | | |
| 4 | Review of Work Product approval process<br><br>*Attendees reviewed the proposed flow chart for Work Product approval. Coy indicated that he was comfortable with the process depicted and echoed the group's opinion that the approval process enhance the usefulness of the work products.* | 2:30 | Perry/All |
| 5 | Next steps – discuss availability of members for up to four brief 20 to 30 minute web-based collaborative sessions to develop the first scenario<br><br>*Several attendees expressed limited availability for a working session and that Thursday morning seemed the best opportunity. The session was scheduled for then.* | 2:40 | Perry/All |
| 6 | Adjourn | 2:45 | Perry/All |

EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Review Draft Nevada Family Scenario | | |
| **Date and time:** | October 29, 2013 2:00 P.M. PCST / 3:00 P.M. MST | **Meeting no:** | 17 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | TBD | | |

**Agenda**

| ITEM | DESCRIPTION | TIME | RESPONSIBLE |
|---|---|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting | 2:00 | Perry/All |
| 2 | Roll call RSVPs and others | 2:05 | Perry/All |
| 3 | Read through the scenario | 2:10 | Perry |
| 4 | Critique and refine the scenario | 2:30 | Perry/All |
| 5 | Next steps – discuss activities moving forward | 2:40 | Perry/All |
| 6 | Adjourn | 2:45 | Perry/All |

EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

| | | | |
|---|---|---|---|
| **Group:** | I80 CSMP Energy Infrastructure Working Group | | |
| **Subject:** | Enhanced Nevada Family Scenario and Graphics | | |
| **Date and time:** | November 12, 2013 2:00 P.M. PCST / 3:00 P.M. MST | **Meeting no:** | 18 |
| **Meeting place:** | Teleconference | **Minutes by:** | Perry |
| **Attendees:** | TBD | | |

**Agenda**

| ITEM | DESCRIPTION | TIME | RESPONSIBLE |
|---|---|---|---|
| 1 | Chat or Mute while individuals get organized for the meeting | 2:00 | Perry/All |
| 2 | Roll call RSVPs and others | 2:05 | Perry/All |
| 3 | Review additional scenario elements | 2:10 | Perry |
| 4 | Critique and refine the scenario | 2:20 | Perry/All |
| 5 | Next steps – discuss activities moving forward | 2:30 | Perry/All |
| 6 | Adjourn | 2:35 | Perry/All |

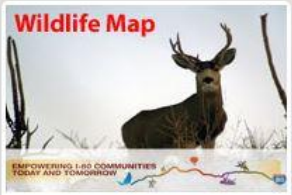
EMPOWERING I-80 COMMUNITIES TODAY AND TOMORROW

# I-80 Corridor Stakeholder Network Map Gallery

Search maps

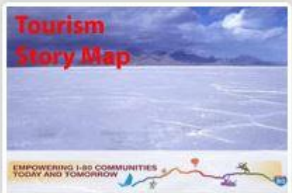











1

Welcome to the map gallery for the **I-80 Corridor Stakeholder Network** —a partnership to provide mobility and transportation solutions throughout the I-80 corridor, now and well into the future. This project includes partner states **California, Nevada, Utah, and Wyoming**.

This map gallery hosts maps of diverse working groups exploring multiple dimensions of the I-80 corridor communities and the implications these different dimensions imply for supporting infrastructure.

** Please browse through the map gallery and click on the map of your interest to explore that content in a full screen map application that opens in a new window!**

**Project Website**

Contact Information:

Coy J. Peacock

Statewide TSP Coordinator

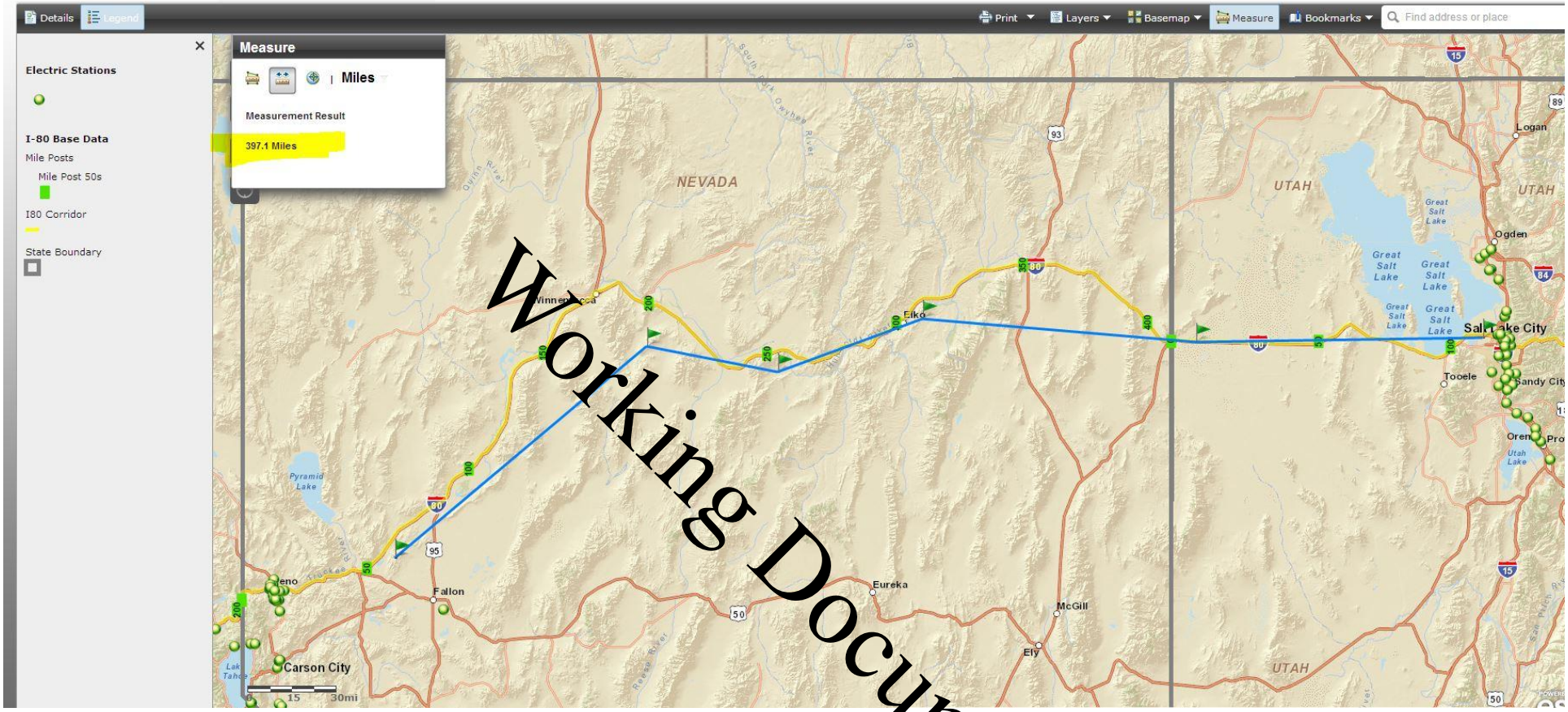
Transportation/Multimodal Planning Division

NV Dept. of Transportation

cpeacock@dot.state.nv.us

775-888-7124

# I-80 Alternative Fuel Stations



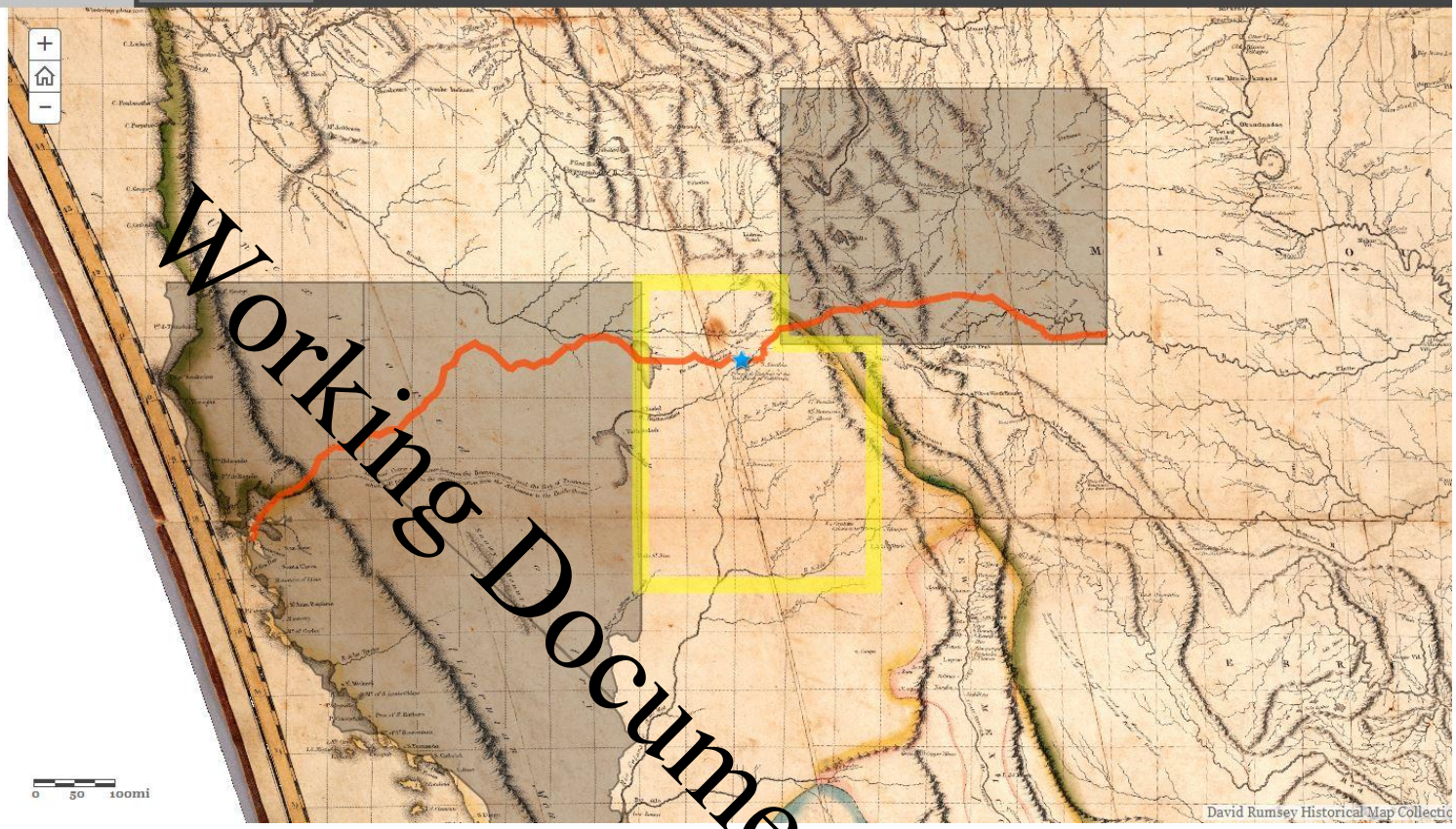
## I-80 Corridor - Pre Western Settlement

Many Native American peoples came to live in the areas that would become the Western United States. Their respect and honoring of nature provided them with ability to live in harmony with their surroundings. From the coast of California to the Great Basin of Nevada and Utah to the high mountains of Wyoming, Native Americans found a diversity of food and resourceful ways to band together as families, no matter the situation. One key element for both food supplies and the maintenance of bands of families was the use of fire for increasing the "edge effect," which gave the families greater security and stability to their lives.

California | Nevada | Utah | Wyoming

### I80 - Pre Western Settlement in Utah

This is the traditional home of the Ute. While the Paiute and Shoshone traveled the western extents of Utah, the Northern Ute lived in the Wasatch Mountains and Uintah Basin in eastern Utah valleys. The Ute carry many of the traditions of the Great Plains tribes including a warrior culture and the horse. Much of the warrior culture focused on maintaining control of their traditional lands from other tribes. This way of life led to a focus on traditional ceremonies and the use of ceremonial herbs. The Whiteriver, Uintah, and Uncompahgre Ute bands are exceptional artists producing religious and ceremonial beadwork and art forms including the designing and decorating weapons of war. The horse served as a central focus of tribal life after its introduction.



# I80 - Western Settlement in Wyoming

Communities along the Oregon and California Trails, eventually the I-80 Corridor came into being in interesting and varied ways. While much of these activities began with the movement of settlers from the east to the west toward California, many treasures discovered along the way led to many other interesting stories of settlement. The events between roughly the mid-1800s to the mid-1900s continue shaping the future of I-80 Corridor communities. The adage the more things change the more they stay the same may be at play.

Wyoming | Utah | Nevada | California

## I80 - Western Settlement in Wyoming

John Colter, in 1807 discovered a region of steaming geysers and towering water falls that in 1872 began the United States' National Park with Yellowstone as a place to be enjoyed by all. However, Wyoming's early settlement in part to Europe's fondness of beaver top hats. Early-day trappers, including Kit Carson, Jim Bridger, Davey Jackson and Jedediah Smith roam the Wyoming territory in search of the prized pelts. Other early western settlement came from gold in California and rich land in Oregon bringing pioneer wagon trains over the Oregon Trails through Wyoming. Western military posts, such as Ft. Laramie in southeastern Wyoming became gold seekers and emigrants' haven as well as a station for the Pony Express and the Overland stagecoaches. Wyoming's great herds of buffalo give rise to one of the state's best known citizens, William F. "Buffalo Bill" Cody. Near the turn of the century, Buffalo Bill took

LEGEND

**State Capital**

**Wyoming**

**Other I80 States**

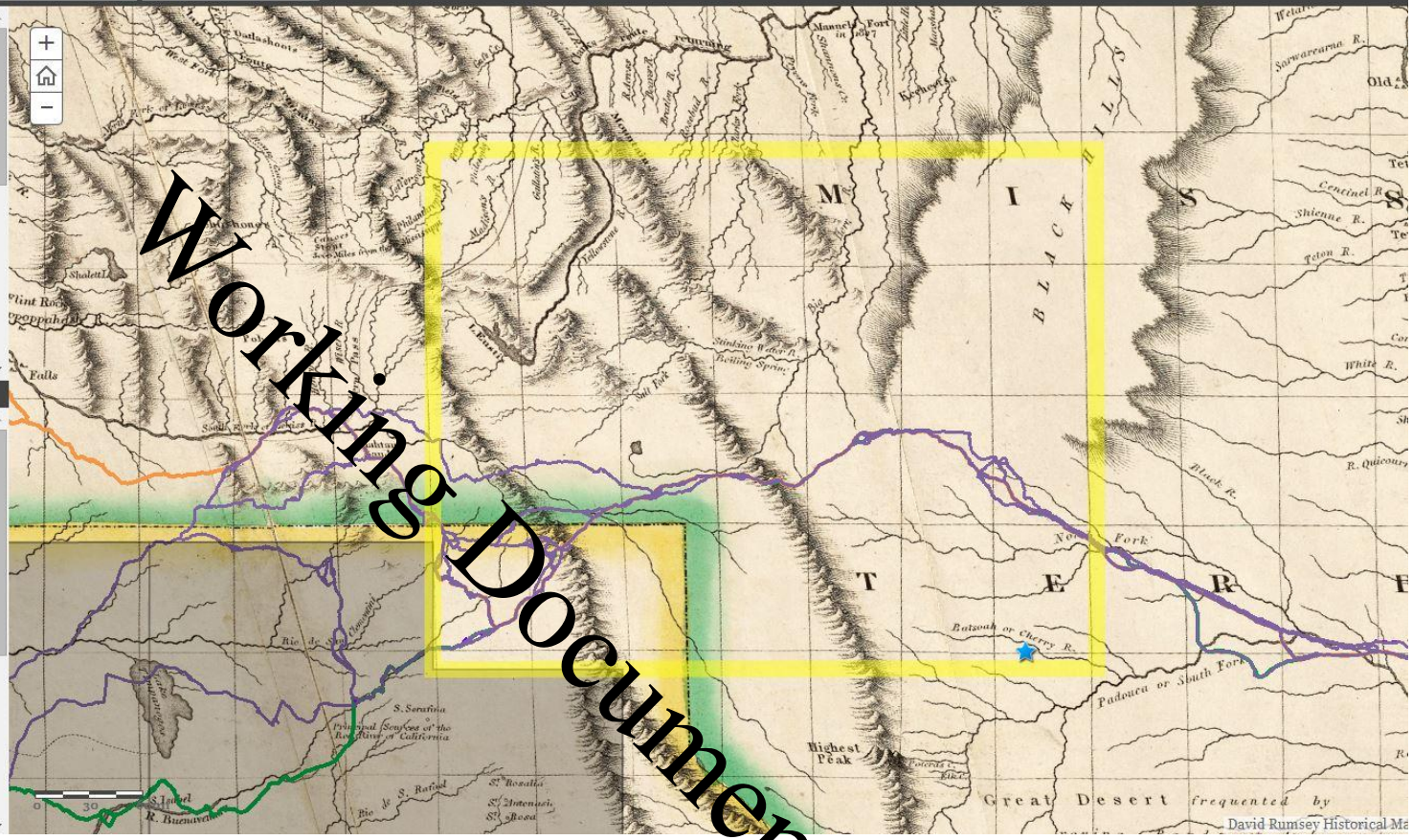
**National Historic Trails**

California

El Camino Real de Tierra Adentro

El Camino Real de los Tejas

Trail of Tears



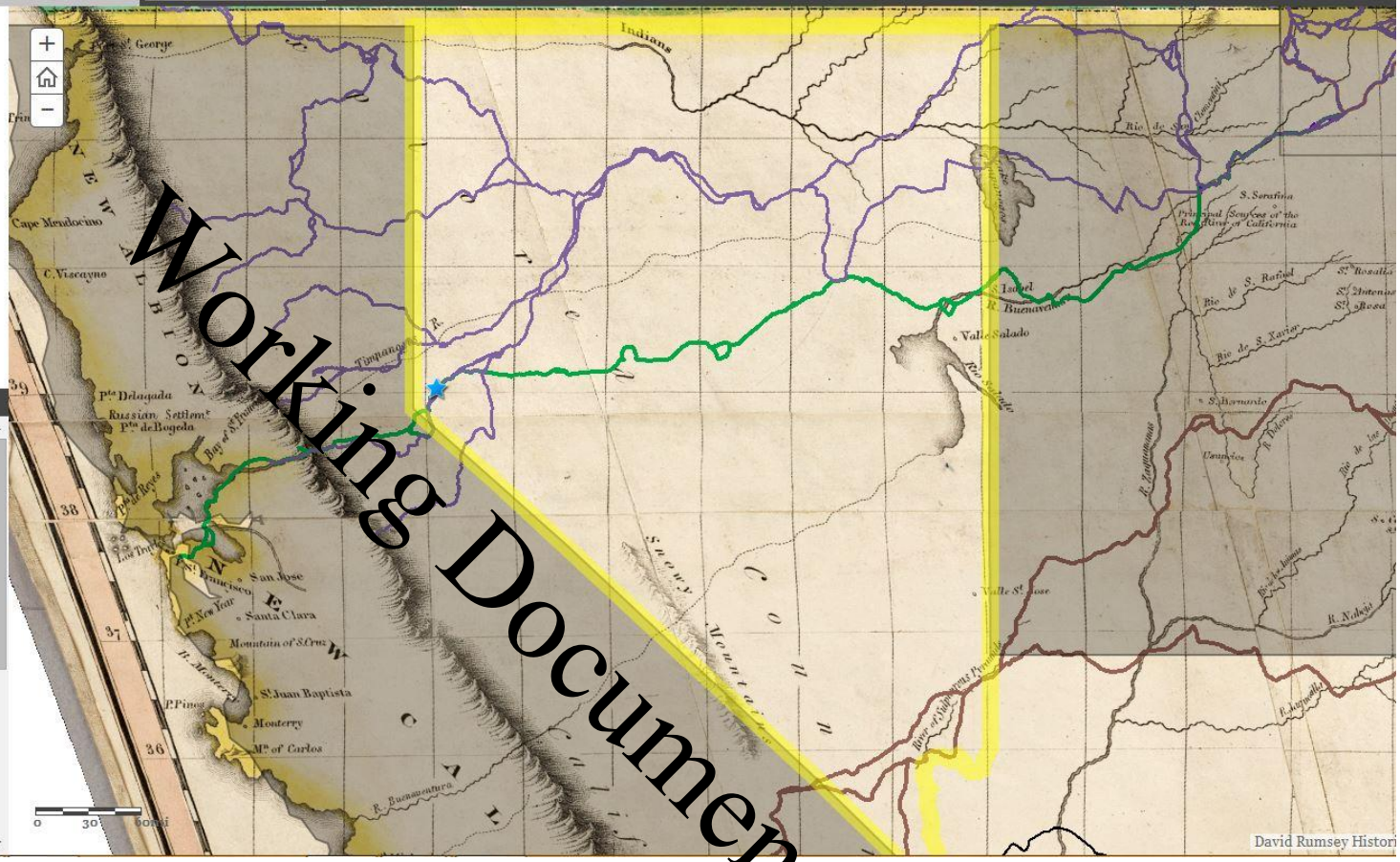
# I80 - Western Settlement in Wyoming

Communities along the Oregon and California Trails, eventually the I-80 Corridor came into being in interesting and varied ways. While much of these activities began with the movement of settlers from the east to the west toward California, many treasures discovered along the way led to many other interesting stories of settlement. The events between roughly the mid-1800s to the mid-1900s continue shaping the future of I-80 Corridor communities. The adage the more things change the more they stay the same may be at play.

Wyoming | Utah | Nevada | California

## I80 - Western Settlement in Nevada

Place Text Here.






LEGEND

**State Capital**

**Nevada**

**Other I80 States**

**National Historic Trails**

California

El Camino Real de Tierra Adentro

El Camino Real de los Tejas

Trail of Tears

**Art of the Long View Scenario Planning (Peter Schwartz, Author)**
* adapted from }getAbstract compressed knowledge, 2009 at
http://lobsta.uri.edu/hc/documents/art-of-the-long-view-schwartz-e-1.pdf

**Individual Principles of Scenario Construction**
Effective scenario planning relies on the collective insight gained from individual *ah ha moments*. Central to achieving ah hah moments is openly coping with uncertainty by exploring choice. Choice comes from collection of assumptions about the nature of the world and what could and what is likely to happen: a *decision agenda*. Decision agendas must move from the unspoken level to the conscience level in order to consider what the future will be like. Practice seeing the world from different perspectives. Imagine optimistic, pessimistic, and status quo futures. Compare your current future images and mind-set to those you had last year or even earlier. Expand your perspective by seeking rich, diverse and thought provoking data such as:

> **Science and technology** – Scientists are always making breakthroughs and discovering new technologies that change what is possible. Monitor these changes with awareness of how they apply to your particular interests.
>
> **Perception-shaping events** – Some specific moments can crystallize public understanding or shift public opinion. The Supreme Court Justice Clarence Thomas' Senate confirmation hearing changed many people's perspective of sexual harassment.
>
> **Music** – Pop music reflects how the emerging generation sees the world.
>
> **Fringes** – Humans structure knowledge *concentrically* with essential beliefs at the core. The farther out ideas go from that center, the less important they seem to be to established society. But, innovation comes from the edges, where people try new ideas. You'll leap ahead if you can identify useful ideas in fringe cultures or publications.

A diverse set of individuals having multiple perspectives shaped by their own exploration of data have the potential to generate valuable scenarios.

**Core Scenario Components**
Each time you build a scenario, incorporate three essential interacting components:

1. **Driving forces** – These dominant factors shape your professional arena. Phrase the core question to be answered. Review all the major forces that will shape actions. Many forces will be instinctively identified. Since people have blind spots we will build our scenarios as a team. Work systematically through social influences, technological factors, economic and political influences, and environmental implications. These categories manifest differently for every question explored, even in every decision, so will always take them into account.

- Finally, complete your scenario building by identifying a few signs to watch for as signals that a given future is coming into being.

**Sample Scenario Plots**
Many plot lines exist and can be adapted. The following are examples for consideration.

**Winners and losers** plot depicts a zero-sum future, where one group wins (survives, gets rich) and the other loses. This plot dominates economics and politics (only one candidate can win), creating a binary world with strategic, often *overt alliances*.

**Challenge and response** plot in which one side generates a challenge, the other side shifts or grows in reaction. This plot often begins as a zero-sum winner-and-loser plot that ends as a mutual gains plot.

**Evolution** plot follow a *biological* path where continual change occurs in a given direction, *either growth or decline*. Once you identify these slow-developing scenarios, planning for them is relatively easy. An example might be creating a new robotic machine. People must learn to use it and integrate it before it becomes useful.

**Revolution** plots changes everything in response to a specific event, such as the 1929 stock market crash. Such changes are rare, but important, because they shift how people see the world going forward.

**Cycles** plots are common in economics. If you're in a cyclical field, learn to read cues that tell you when the elements in your cycle will change direction. For instance, when the money supply increases, interest rates drop, people borrow more, so they spend more and interest rates go back up.

**Infinite possibility** plots make events inevitable and seem as if anything could happen. Some demographic bulges have their own drive such as *My Generation* in the 1960s based on a sense of identity.

**Lone Ranger** plotlines pit a single heroic individual against a system.

2. **Predetermined elements** – These scenario factors will remain the same, no matter what path you take. To find predetermined elements, look at *slow-changing phenomena*, such as the rate of population change. Note *constraining factors*, for example, the fact that Japan has a large population but limited land. Look at *factors in the pipeline*, such as demographic bulges, like people who are retiring. Be aware of *inevitable collisions*, like the clash between public demand for services and opposition to taxes.

3. **Critical uncertainties** – These are factors you aren't sure about, but which you know are *related to your arena's predetermined elements*. To identify them, challenge your assumptions. How might things that you believe are predetermined actually change? For instance, until technology enabled telecommuting, you would have said that people will always need to get to work. New capacities have created other possibilities.

**The Process of Constructing Scenarios**
Every scenario is different. The basic process is the same each time.

- Identify the *focal issue or decision*.
- Shape a question.
- Review all specific, local factors that affect issue.
- Identify and rank the driving forces. Which factors are most important; most certain, or will remain constant throughout any scenario.
- Analyze how driving forces relate to your situation. Look at how driving forces shape the environment including how that might change.
- Generate at least three distinct possible futures. Build each scenario around a specific unifying logic or *plot* (note the examples that follow). Use plots to organize scenario details, events and characters.
- Scenario building team members engage individual specific research about your situation. This ongoing research is discussed within the group in order to generate new possibilities during subsequent discussions.
- Group members must *suspend disbelief* to generate different futures. Devise plots that try out various choices.
- Brainstorm as a team to identify the plot *logics* that fit your focal issue and *flesh out* the story. Work through each scenario's driving forces, predetermined elements, and critical uncertainties.
- Focus on details such as exactly who is involved, how, why, the individual actors and their interactions? How do the plots shift and why.
- Remember that few historical trends continue without modification. Draw on history. Take a specific period of historical change and work back 10 years. What clues hinted that a given change was going to happen? What could you have done to prepare for this change?
- Consider each scenario's implications collectively. What have you learned through these scenarios? Which decision appears sound in which possible futures? Where are they flawed or dangerous? Beware of a decision that works in only one possible future, since you can't be certain that future will happen.


## DRIVING FORCES

**Generational Expectation**: Different generational expectation informed by pop culture for older and hyper interconnectedness for younger generations. These different expectations are changing future decision makers.

**Economic and Political Accountability**: Increasing attention is being paid to economic and political accountability while exploring new revenue sources such as fuel tax, vehicle miles traveled, cap and trade, among others.

**Enabling and Scuttling Policies**: There are enabling and scuttling effects of different policies in terms of environmental implications and political influences. Many will want to correct past wrongs.

**Great Expectations**: There is wide variability in alternative fuel technologies including the range in expectations for new and innovative technologies (wow factor).

**Showing Progress**: Human nature is impatient and influenced by T.V., movies, and the media suggesting the need to continually show progress.

**Mutually Beneficial**: Economic development pressures and homegrown renewable power generation can be mutually beneficial pursuits.



## PREDETERMINED ELEMENTS

**Demographic Shifts**: The retiring Baby Boomers, or grey tsunami and the increasing minority population will change the composition of the work force and mobility preferences.

**Environmental Considerations**: Social acceptance of environmental concerns continues facing challenges of beliefs, resources, and entrenched interests.

**Vastness of the West**: There are long distances between communities in the west that challenge the provision of infrastructure for competing alternative energy sources.

**Thresholds and Cascades**: While government organizations, policies, preferences for oil, and human adaptation to technology change slowly, they have a relatively high probability of having a threshold past which change will occur quickly.

**Views of Society**: Broadly, there are different views of society as the Great Society or the Capitalist Society.

**Competing Interests**: Fixed resources present either/or decisions such as bio-fuels or food supply.

## CRITICAL UNCERTAINTIES

**All the Above**: The current broad acceptance that all alternative energy sources are needed for the future appears viable unless oil companies stop diversifying.

**Regime Change**: Elections that change political ideologies at all levels of government influence policy development and implementation.

**The Great Recession**: The Great Recession likely change how some people act and behave and we are not sure how that will affect the now or when another recession occurs.

**Technological Leaps**: We are experiencing an escalation in technological leaps and acceleration in the time between these leaps.

**Beta verses VHS**: Businesses often seek a competitive advantage by introducing proprietary products for similar functionalities.

# I-80 Corridor System Master Plan Study:
# Energy Infrastructure Working Group
# Scenario Planning

**Table 1: Potential Scenarios with Identified Situational Framework**



| SITUATIONAL FRAMEWORK | POTENETIAL SCENARIOS | | | | | | |
|---|---|---|---|---|---|---|---|
| | Winners and losers | Challenge and response | Evolution | Revolution | Cycles | Infinite possibility | Lone Ranger |
| **Michener Plot Elements** | | California Family | Nevada Family | | Wyoming Family | Utah Family | |
| **DRIVING FORCES** | | | | | | | |
| **Generational Expectation** | | | | | | | |
| **Economic and Political Accountability** | | | | | | | |
| **Enabling and Scuttling Policies** | | | | | | | |
| **Great Expectations** | | | | | | | |
| **Showing Progress** | | | | | | | |
| **Mutually Beneficial** | | | | | | | |
| **PREDETERMINED ELEMENTS** | | | | | | | |
| **Demographic Shifts** | | | | | | | |
| **Environmental Considerations** | | | | | | | |
| **Vastness of the West** | | | | | | | |
| **Thresholds and Cascades** | | | | | | | |
| **Views of Society** | | | | | | | |
| **Competing Interests** | | | | | | | |
| **CRITICAL UNCERTAINTIES** | | | | | | | |
| **All the Above** | | | | | | | |
| **Regime Change** | | | | | | | |
| **The Great Recession** | | | | | | | |
| **Technological Leaps** | | | | | | | |
| **Beta verses VHS** | | | | | | | |

## Table 2: Description of Scenario Planning Elements

| SCENARIOS | PREDETERMINED ELEMENTS |
|---|---|
| **Winners and losers** plot depicts a zero-sum future, where one group wins (survives, gets rich) and the other loses. This plot dominates economics and politics (only one candidate can win), creating a binary world with strategic, often *overt alliances*. | **Demographic Shifts**: The retiring Baby Boomers, or grey tsunami and the increasing minority population will change the composition of the work force and mobility preferences. |
| **Challenge and response** plot in which one side generates a challenge, the other side shifts or grows in reaction. This plot often begins as a zero-sum, winner-and-loser plot that ends as a mutual gains plot. | **Environmental Considerations**: Social acceptance of environmental concerns continues facing challenges of beliefs, resources, and entrenched interests. |
| **Evolution** plot follow a *biological* path where continual change occurs in a given direction, *either growth or decline*. Once you identify these slow-developing scenarios, planning for them is relatively easy. An example might be creating a new robotic machine. People must learn to use it and integrate it before it becomes useful. | **Vastness of the West**: There are long distances between communities in the west that challenge the provision of infrastructure for competing alternative energy sources. |
| **Revolution** plots changes everything in response to a specific event such as the 1929 stock market crash. Such changes are rare, but important, because they shift how people see the world going forward. | **Thresholds and Cascades**: While government organizations, policies, preferences for oil, and human adaptation to technology change slowly, they have a relatively high probability of having a threshold past which change will occur quickly. |
| **Cycles** plots are common in economics. If you're in a cyclical field, learn to read cues that tell you when the elements in your cycle will change direction. For instance, when the money supply increases, interest rates drop, people borrow more, so they spend more and interest rates go back up. | **Views of Society**: Broadly, there are different views of society as the Great Society or the Capitalist Society. |
| **Infinite possibility** plots make events inevitable and seem as if anything could happen. Some demographic bulges have their own drive such as *My Generation* in the 1960s based on a sense of identity. | **Competing Interests**: Fixed resources present either/or decisions such as bio-fuels or food supply. |
| **Lone Ranger** plotlines pit a single heroic individual against a system. | |
| **DRIVING FORCES** | **CRITICAL UNCERTANTIES** |
| **Generational Expectation**: Different generational expectation informed by pop culture for older and hyper interconnectedness for younger generations. These different expectations are changing future decision makers. | **All the Above**: The current broad acceptance that all alternative energy sources are needed for the future appears viable unless oil companies stop diversifying. |
| **Economic and Political Accountability**: Increasing attention is being paid to economic and political accountability while exploring new revenue sources such as fuel tax, vehicle miles traveled, cap and trade, among others. | **Regime Change**: Elections that change political ideologies at all levels of government influence policy development and implementation. |
| **Enabling and Scuttling Policies**: There are enabling and scuttling effects of different policies in terms of environmental implications and political influences. Many will want to correct past wrongs. | **The Great Recession**: The Great Recession likely change how some people act and behave and we are not sure how that will affect the now or when another recession occurs. |
| **Great Expectations**: There is wide variability in alternative fuel technologies including the range in expectations for new and innovative technologies (wow factor). | **Technological Leaps**: We are experiencing an escalation in technological leaps and acceleration in the time between these leaps. |
| **Showing Progress**: Human nature is impatient and influenced by T.V., movies, and the media suggesting the need to continually show progress. | **Beta verses VHS**: Businesses often seek a competitive advantage by introducing proprietary products for similar functionalities. |
| **Mutually Beneficial**: Economic development pressures and homegrown renewable power generation can be mutually beneficial pursuits. | |

| Michener Plot Elements | Nevada Family |
|---|---|
| **DRIVING FORCES** | |
| **Generational Expectation** | |
| **Economic and Political Accountability** | |
| **Enabling and Scuttling Policies** | |
| **Great Expectations** | |
| **Showing Progress** | |
| **Mutually Beneficial** | |
| **PREDETERMINED ELEMENTS** | |
| **Demographic Shifts** | |
| **Environmental Considerations** | |
| **Vastness of the West** | |
| **Thresholds and Cascades** | |
| **Views of Society** | |
| **Competing Interests** | |
| **CRITICAL UNCERTAINTIES** | |
| **All the Above** | |
| **Regime Change** | |
| **The Great Recession** | |
| **Technological Leaps** | |
| **Beta verses VHS** | |

## 64 Heuristics for Problem Solving (Adapted from David Straus, 2004)

<table>
<tr><td colspan="2">Meta Heuristics<br>Change<br>Vary<br>Cycle<br>Repeat</td></tr>
<tr><td>Master Heuristics<br>Build Up - Eliminate<br>Work Forward - Work Backward</td><td>Strategies for Information Retrieval<br>Memorize – Recall<br>Record – Retrieve<br>Search - Select</td></tr>
<tr><td>Strategies for Set Manipulation<br>Associate - Classify<br>Generalize – Exemplify<br>Compare – Relate</td><td>Strategies for Dealing with the Future<br>Plan – Predict<br>Assume – Question<br>Hypothesize – Guess<br>Define – Symbolize<br>Simulate – Test</td></tr>
<tr><td>Strategies for Involvement<br>Commit – Defer<br>Leap In – Hold Back<br>Focus – Release<br>Focus – Relax<br>Dream – Imagine<br>Purge - Incubate</td><td>Strategies for Physical Manipulation<br>Play – Manipulate<br>Copy – Interpret<br>Transform – Translate<br>Expand – Reduce<br>Exaggerate – Understate<br>Adapt – Substitute<br>Combine - Seperate</td></tr>
<tr><td>Strategies for Manipulating Information<br>Display – Organize<br>List – Check<br>Diagram – Chart<br>Verbalize - Visualize</td><td></td></tr>
</table>

**Energy notes: Energy in natural processes and human consumption, some numbers H A&S 220c Fall 2004 19x2004**

The average person in the US consumes 60 barrels of oil (2520 gallons) per year and on average this is 10,000 watts of power consumption (the calculation is made relatively easy by consulting tables below and keeping track of units: [2520 gallons /yr x 125 x $10^6$ J/gallon ]/ [$\pi$ x $10^7$ sec./yr] = 1.00 x$10^4$ watts). It is a useful coincidence that the number of seconds in a year is $\pi$ x $10^7$ to within half of one percent.

# Rough Values of Power of Various Processes (watts)



| | |
|---|---|
| Solar power in all directions | $10^{27}$ |
| Solar power incident on earth | $10^{17}$ |
| Solar power avg. on U.S. | $10^{15}$ |
| Solar power consumed in photosynthesis | $10^{14}$ |
| U.S. power consumption rate | $10^{13}$ |
| U.S. electrical power | $10^{12}$ |
| Large electrical generating plant | $10^9$ |
| Automobile at 40 mph…note this is not the output which only about 30% of the energy input..PBR | $10^5$ |
| Solar power on roof of U.S. home | $10^4$ |
| U.S. citizen consumption rate | $10^4$ |
| Electric stove | $10^4$ |
| Solar power per $m^2$ on U.S. surface …this seems a little low…it's 1342 watts per $m^2$ outside the atmosphere, about 1000 watts per $m^2$ at high noon on the ground, and on average (day and night) about 240 watts per meter$^2$ absorbed at the ground. This is the average over the Earth too…PBR | $10^2$ |
| One light bulb | $10^2$ |
| Food consumption rate per capita U.S. | $10^2$ |
| Electric razor | $10^1$ |

# Energy Content of Fuels (in Joules)

| Energy Unit | Joules Equivalent (S.I.) |
|---|---|

| | |
|---|---|
| gallon of gasoline | $1.3 \times 10^8$ |
| AA battery | $10^3$ |
| standard cubic foot of natural gas (SCF) | $1.1 \times 10^6$ |
| candy bar | $10^6$ |
| barrel of crude oil (contains 42 gallons) | $6.1 \times 10^9$ |
| pound of coal | $1.6 \times 10^7$ |
| pound of gasoline | $2.2 \times 10^7$ |
| pound of oil | $2.4 \times 10^7$ |
| pound of Uranium-235 | $3.7 \times 10^{13}$ |
| ton of coal | $3.2 \times 10^{10}$ |
| ton of Uranium-235 | $7.4 \times 10^{16}$ |

# Energy Conversions

| Energy Unit | Equivalent | | | | |
|---|---|---|---|---|---|
| 1 Btu | 1055 joules | or | 778 ftlb | or | 252 cal |
| 1 calorie | 4.184 joules | | | | |
| 1 food Calorie | 1000 calories | or | 1 kilocalorie | | |
| 1 hp hr | $2.68 \times 10^6$ joules | or | 0.746 kwh | | |
| 1 kwh | $3.6 \times 10^6$ joules | or | 3413 Btu | | |
| 1 eV | $1.6 \times 10^{-19}$ joules | | | | |



**Fuel Requirements for a 1000MWe Power Plant =$10^9$ watts**

**(2.4 $10^{11}$ Btu/day energy input)**

**=$2.53 \times 10^{14}$ joules/day = $2.9 \times 10^9$ watts = 2200 Mwatts thermal fuel energy**

---

Coal: 9000 tons/day of 1 "unit train load" (100 90 - ton cars/day)

Oil: 40,000 bbl/day or 1 tanker per week (note: "bbl" means barrels)

Natural Gas: 2.4 $l0^8$ SCF/day

Uranium (as $^{235}U$): 3 kg/day

Note: 1000 MWe utility, at 60% load factor, = 6 x $10^5$ kw generates 5.3 x $10^9$ kwh/year, enough for a city of about 1 million people in the U.S.A ; this is just their electricity needs, at about 0.6 kw per person

(Note: MWE is an abbreviation for megawatts-electrical output)

# Global Energy Consumption

---

Global Energy consumption (marketable energy): about 400 exaJoules per year = 4 x $10^{20}$ J/yr

U.S. Total Energy Consumption (1990)

= 82.1$10^{15}$ Btu (82.1 Quads) = 38.8 MBPD oil equivalent = 86.6x$10^9$ GJ = 86.6 exaJoule; (recall 1 Quad is a quadrillion ($10^{15}$) BTU or 1.055 exaJoules (1.055 x $10^{18}$ Joules). Since 1990 we've gone up.



# Everyday Usage and Energy Equivalencies

---

1 barrel of oil = 42 gallons: driving 1400 km (840 miles) in average car

1 kwh electricity = 1½ hours of operation of standard air conditioner

= 92 days for electric clock

= 24 hours for color TV

## One million Btu equals approximately

---

90 pounds of coal

125 pounds of ovendried wood

8 gallons of motor gasoline

10 therms of natural gas

1.1 day energy consumption per capita in the U.S.

Power is the amount of energy used per unit time - or how fast energy is being used. If we multiply a unit of power by a unit of time, the result is a unit of energy. Example: kilowatt-hour.

# Power Conversions

| Power Unit | Equivalent | | | | |
|---|---|---|---|---|---|
| 1 watt | 1 joule/s | or | 3.41 Btu/hr | | |
| 1 hp | | or | 2545 Btu/hr | or | 746 watts |

# Power Converted to Watts

| Quantity | Equivalent |
|---|---|
| 1 Btu per hour | 0.293 W |
| 1 joule per second | 1 W |
| 1 kilowatt-hour per day | 41.7 W |
| 1 food Calorie per minute | 69.77 W |
| 1 horsepower | 745.7 W |
| 1 kilowatt | 1000 W |
| 1 Btu per second | 1054 W |
| 1 gallon of gasoline per hour | 39 kW |
| 1 million barrels of oil per day | 73 GW |



## Rough Values of the Energies of Various Events

| Occurrence | Energy (J) |
|---|---|
| Creation of the Universe | $10^{68}$ |
| Emission from a radio galaxy | $10^{55}$ |
| $E = mc^2$ of the Sun | $10^{47}$ |
| Supernova explosion | $10^{44}$ |
| Yearly solar emission | $10^{34}$ |
| Earth moving in orbit | $10^{33}$ |

| | |
|---|---|
| D-D fusion energy possible from worlds oceans | $10^{31}$ |
| Earth spinning | $10^{29}$ |
| Earth's annual sunshine | $10^{25}$ |
| Cretaceous-Tertiary extinction theory meteorite | $10^{23}$ |
| Energy available from earth's fossil fuels | $10^{23}$ |
| Yearly U.S. sunshine | $10^{23}$ |
| tidal friction (which drives the moon slowly away from Earth and lengthens the day steadily) | $10^{20}$ |
| U.S. energy consumption | $10^{20}$ |
| Exploding volcano (Krakatoa) | $10^{19}$ |
| Severe earthquake (Richter 8) | $10^{18}$ |
| 100-megaton H-bomb | $10^{17}$ |
| Fission one ton of Uranium | $10^{17}$ |
| $E = mc^2$ of 1 kilogram | $10^{17}$ |
| Burning a million tons of coal | $10^{16}$ |
| Energy to create Meteor Crater in Arizona | $10^{16}$ |
| 1000-MW power station (1 year) | $10^{16}$ |
| Hurricane | $10^{15}$ |
| Thunderstorm | $10^{15}$ |
| Atomic Bomb (Hiroshima) | $10^{14}$ |
| $E = mc^2$ of 1 gram | $10^{14}$ |
| Energy to put the space shuttle in orbit | $10^{13}$ |
| Energy used in one year per capita U.S. | $10^{12}$ |
| Atlantic crossing (one way) of jet airliner | $10^{12}$ |

| | |
|---|---|
| *Saturn V* rocket | $10^{11}$ |
| Energy to heat a house for one year | $10^{11}$ |
| D-D fusion energy possible from 1 gal. of water | $10^{11}$ |
| One year of electricity for the average house | $10^{10}$ |
| Lightening bolt | $10^{10}$ |
| Burning a cord of wood | $10^{10}$ |
| One gallon of gasoline | $10^{8}$ |
| 100-W light bulb left on for one day | $10^{7}$ |
| Human daily diet | $10^{7}$ |
| One day of heavy manual labor | $10^{7}$ |
| Explosion of 1 kg of TNT | $10^{6}$ |
| Woman running for 1 hr | $10^{6}$ |
| Candy bar | $10^{6}$ |
| Burning match | $10^{3}$ |

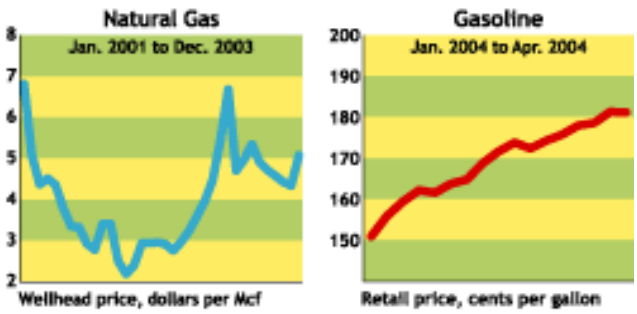
| | |
|---|---|
| 1AA battery (alkaline) | $10^3$ |
| Hard-hit baseball | $10^3$ |
| Lifting an apple 1 m | 1 |
| Human heartbeat | 0.5 |
| Depressing typewriter key | $10^{-2}$ |
| Cricket chirrup | $10^{-3}$ |
| Hopping flea | $10^{-7}$ |
| Proton accelerated to high energy (one trillion eV) | $10^{-7}$ |
| Fission of 1 uranium nucleus | $10^{-11}$ |
| Energy released in D-D fusion | $10^{-12}$ |
| Electron mass-energy | $10^{-13}$ |
| Chemical reaction per atom | $10^{-18}$ |
| Photon of light | $10^{-19}$ |
| Energy of room-temperature air molecule | $10^{-21}$ |

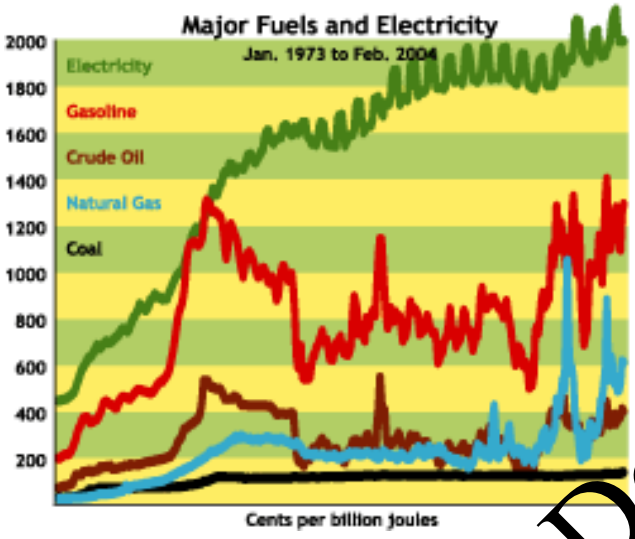
# Cost of Various Fuels

| Type | Unit | Cost $/Unit | Cost $/Joule | Uses |
|---|---|---|---|---|
| Electricity | 1Kwh=3.6x$10^6$J (3.6 MJ) | $0.10 | 0.028 $/MJ = 2.8x$10^{-8}$ | appliances, motors |
| Gasoline | 1 gallon | 2.00 | 0.013 $/MJ = 1.3x$10^{-8}$ | transportation |
| Natural Gas | 1 Therm | 0.60 | similar to gasoline | heating |
| AA battery | 1 battery | 0.80 | 0.8 x $10^{-3}$ | portable electronics |
| Milky Way candy bar | 1 bar | 0.60 | 0.60/MJ = 0.6 x $10^{-6}$ | food |



(but note, although electricity is twice as expensive as gasoline per unit of energy, electric motors are typically much more efficient than gasoline engines, so that electricity as a fuel source can be competitive with gasoline).




http://physics.ucsd.edu/~tmurphy/phys12/phys12.html



# Worldwide Power Use - History

"Developed" countries average (1990):

- 1.2 billion people 7.5 kilowatts/per person = 9.0 terawatts

The rest of the world (1990):

- 4.1 billion people 1.1 kilowatts/person = 4.5 terawatts

(*…we got a slightly different number for 2000…taking 400 exaJoules/year and dividing by 6 Billion people gave 2.11 kw per person..average power consumption..24 hrs a day*!..has it changed? Here we used the interesting fact that there are $\pi \times 10^7$ seconds per year…to a good approx. PBR)

| World Population (est.) (billion persons) | Year | Average Power Use (terawatts) |
|---|---|---|
| 5.5 | 1990 | 13.5 |
| 3.6 | 1970 | 8.4 |

| | | |
|---|---|---|
| 2.5 | 1959 | 3.2 |
| 2.0 | 1930 | 2.3 |
| 1.7 | 1910 | 1.6 |
| 1.5 | 1890 | 1 |

---

## Areas and crop yields

- 1.0 hectare = 10,000 $m^2$ (an area 100 m x 100 m, or 328 x 328 ft) = 2.47 acres
- 1.0 $km^2$ = 100 hectares = 247 acres
- 1.0 acre = 0.405 hectares
- 1.0 US ton/acre = 2.24 t/ha
- 1 metric tonne/hectare = 0.446 ton/acre
- 100 g/$m^2$ = 1.0 tonne/hectare = 892 lb/acre
    - for example, a "target" bioenergy crop yield might be: 5.0 US tons/acre (10,000 lb/acre) = 11.2 tonnes/hectare (1120 g/$m^2$)

---

## Biomass energy

- **Cord:** a stack of wood comprising 128 cubic feet (3.62 $m^3$); standard dimensions are 4 x 4 x 8 feet, including air space and bark. One cord contains approx. 1.2 U.S. tons (oven-dry) = 2400 pounds = 1089 kg
    - 1.0 metric tonne (that is, 1000 kg) **wood** = 1.4 cubic meters (solid wood, not stacked)
    - Energy content of **wood fuel** (HHV, bone dry) = 18-22 GJ/t = 18-22 MJ/kg (7,600-9,600 Btu/lb)
    - Energy content of **wood fuel** (air dry, 20% moisture) = about 15 GJ/t (or 15 MJ/kg) ( or 6,400 Btu/lb)
- Energy content of **agricultural residues** (range due to moisture content) = 10-17 GJ/t (4,300-7,300 Btu/lb)
- Metric tonne **charcoal** = 30 GJ (= 12,800 Btu/lb) (but usually derived from 6-12 t air-dry wood, i.e. 90-180 GJ original energy content)
- Metric tonne **ethanol** = 7.94 petroleum barrels = 1262 liters
    - ethanol energy content (LHV) = 11,500 Btu/lb = 75,700 Btu/gallon = 26.7 GJ/t = 21.1 MJ/liter. HHV for ethanol = 84,000 Btu/gallon = 89 MJ/gallon = 23.4 MJ/liter
    - ethanol density (average) = 0.79 g/ml (= metric tonnes/$m^3$)
- Metric tonne **biodiesel** = 37.8 GJ (33.3 - 35.7 MJ/liter)

- biodiesel density (average) = 0.88 g/ml (= metric tonnes/$m^3$)

## Fossil fuels

- **Barrel of oil** equivalent (boe) = approx. 6.1 GJ (5.8 million Btu), equivalent to 1,700 kWh. ***One "Petroleum barrel" is a liquid measure equal to 42 U.S. gallons*** (35 Imperial gallons or 159 liters); about 7.2 barrels oil are equivalent to one tonne of oil (metric) = 42-45 GJ.
- **Gasoline:** US gallon = 115,000 Btu = 121 MJ = 32 MJ/liter (LHV). 'Premium' or HHV gasoline = 125,000 Btu/gallon = **132 MJ/gallon** = 35 MJ/liter
  - Metric tonne gasoline = 8.53 barrels = 1356 liter = 43.5 GJ/t (LHV); 47.3 GJ/t (HHV)
  - gasoline density (average) = 0.73 g/ml (= metric tonnes/$m^3$)
- **Petro-diesel** = 130,500 Btu/gallon (36.4 MJ/liter or 42.8 GJ/t)
  - petro-diesel density (average) = 0.84 g/ml (= metric tonnes/$m^3$)
- Note that the energy content (heating value) of petroleum products per unit mass is fairly constant, but their density differs significantly – hence the energy content of a liter, gallon, etc. varies between gasoline, diesel, kerosene.
- Metric tonne **coal** = 27-30 GJ (bituminous/anthracite); 15-19 GJ (lignite/sub-bituminous) (the above ranges are equivalent to 11,500-13,000 Btu/lb and 6,500-8,200 Btu/lb).
  - Note that the energy content (heating value) per unit mass varies greatly between different "ranks" of coal. "Typical" coal (rank not specified) usually means bituminous coal, the most common fuel for power plants (27 GJ/t).
- **Natural gas:** HHV = 1027 Btu/ft3 = 38.3 MJ/$m^3$; LHV = 930 Btu/ft3 = 34.6 MJ/$m^3$
  - Therm (used for natural gas, methane) = 100,000 Btu (= 105.5 MJ)



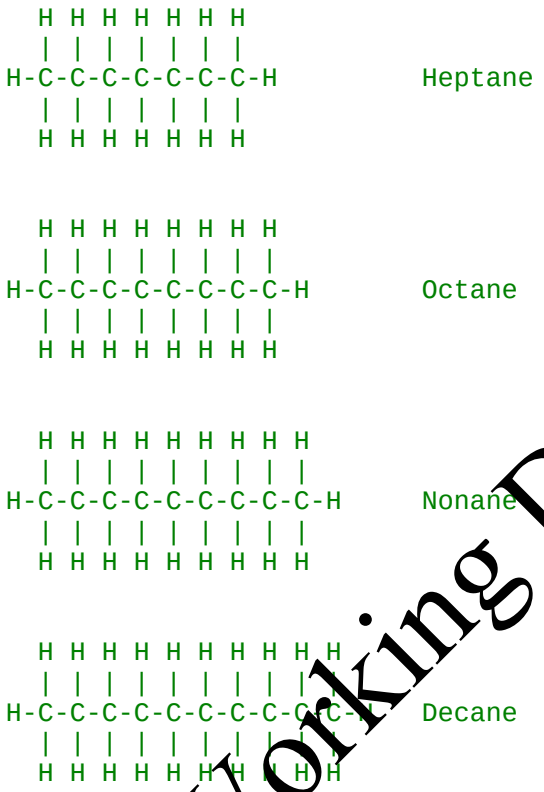
---

## Carbon content of fossil fuels and bioenergy feedstocks

- **coal** (average) = 25.4 metric tonnes carbon per terajoule (TJ)
  - 1.0 metric tonne **coal** = 746 kg carbon
- **oil** (average) = 19.9 metric tonnes carbon / TJ
- 1.0 US gallon **gasoline** (0.833 Imperial gallon, 3.79 liter) = 2.42 kg carbon
- 1.0 US gallon **diesel/fuel oil** (0.833 Imperial gallon, 3.79 liter) = 2.77 kg carbon
- **natural gas (methane)** = 14.4 metric tonnes carbon / TJ
- 1.0 cubic meter **natural gas (methane)** = 0.49 kg carbon
- carbon content of **bioenergy feedstocks:** approx. 50% for woody crops or wood waste; approx. 45% for graminaceous (grass) crops or agricultural residues

GASOLINE:
Energy content: 43 to 47 KJ/gram (that is , 43 – 47 MJ/kg) not much different from candlewax or candybars
(physical density of gasoline is about .73 times that of water (.73 g/cc…it floats!).
Coal has energy content of 15 to 19 KJ/gram

**Typical molecules found in gasoline**




**compare with 'cleaner' natural gas: methane, which has roughly ½ carbon:hydrogen ratio of gasoline**

Great work on it

What would eventually become the communities along the Interstate 80 corridor began millennia ago as geological tempests. As the land plates cooled and stretched over the western part of North America, thinned crust experienced repeated up thrust that produce mountain range after mountain range. The Sierra Nevada, Rubies, and Wasatch mountain ranges are a few the majestic reminders of this geological history. This geological activity produce the fertile inter coastal and central valleys of California, as well as the Great Basin stretching from the eastern slopes of the Sierra Nevada Mountains all the way to the Rocky Mountains of Wyoming. The abundant gold and other precious mineral resources found in Nevada are the result of molten magma being pushed through cracks to the surface by ancient water 30 million years ago. Additional treasures include the open, majestic, pristine vistas and wealth of unique natural flora and fauna resources second only to Hawaii in diversity.

adding test text

In this beginning of the natural flora and fauna were the peoples of the Great Basin: the Paiutes, the Shoshone, and the Ute. Paiute clans settled by enduring sources of water and were named for their primary food source. The Shoshone and Ute shared the naming convention as they traveled as clans around portions of the Great Basin. Pinion nuts, water reeds, ground squirrels, among other resources provided the peoples of the Great Basin with a lifestyle that cherished and existed in harmony with nature.

with nature.

The communities along the I 80 corridor often owe their original settlement to the travelers across the Great Basin. A Google map tells us a trip from San Francisco to Cheyenne should take 18 hours at 75 miles an hour. Historically, humans living and traveling through the Great Basin through time met challenging hardships of sparse water resources, great distances, and often unyielding weather. Communities of the I 80 corridor have historically and continue to help with people's desire for travel. This is the human spirit for the California trail, the transcontinental railroad, the Lincoln Highway, United States Route 40, the modern day Interstate 80.

# Gaps in history

The I 80 corridor communities continue embracing the historical spirit of life in the Great Basin and Columbia Plateau. Rural Nevada communities exemplify the resilience, the resourcefulness, and the ingenuity that continuously provides these communities with human energy necessary to succeed. The Nevada homestead tractor provides one example of these characteristics. Fuel for farm machinery was expensive and heavy requiring considerable effort to transport to remote homestead locations. In order to get the most benefit from these efforts, homesteaders would construct large flywheels that would maximize the amount of work each ounce of fuel could produce on the homestead. These unique farm machines are still on display today as source of pride of heritage.

Elko has spent decades with the open pit mining-based economy. Fortunes rose and fell based upon the price of gold and other minerals. The economy of Northeastern Nevada proved relatively stable through this time because of the worldwide desire for gold and other precious minerals. This is true even of the Great Recession of 2007-2008. The local economy, like economies all over the world was affected by the retraction in construction and development. They struggled with workforce housing but overall weathered the recession pretty well. While the local economy remains strong, it also remains reliant upon the import of energy to support the booming mining economy.

import of energy to support the booming mining economy.

Future

all scenarios could work backwards from achieving the goal of corridor energy self suficiency

Families throughout the Northeast Nevada were dealing with the many different changes during the early decades of the 21st century in the Western United States. Those dedicating their lives to the mining profession believe the current practices of the international mining conglomerates would continue to provide prosperity for the communities. Others of the younger generation with the opportunity to attend Great Basin College began to think about other potential futures. Many of these thought that the natural treasures of the Great Basin, abundant sunlight, accessible geothermal, and the ever present wind might prove to be an even more important potential self reliant source of energy in the future.

Mining precious minerals requires a particular market price for the minerals and the ability to obtain those minerals while achieving a return on investment. A big component of the investment cost is energy to power the massive mining equipment and other production facilities. Just like the original pioneers of the Great Basin, these present-day innovators sought new ways of providing sustainable energy to fuel the economy. At the same time, significant movements were advancing the state-of-the-art in electric vehicle and other alternative fuel technologies such as compressed natural gas and hydrogen. These trends would provide the impetus for the evolution of self reliant energy for the I 80 corridor.



The shale formations in Wyoming were producing significant amounts of natural gas. Students a Great Basin College were studying engine technology with a focus on diesel engines. They experienced an ah ha moment in their research when realizing with adjustments they were able to modify the large diesel engines of mining equipment to utilize compressed natural gas. These innovations motivated CNG producers in the Wyoming fields to install compressed natural gas pipeline from the fields westward toward California. This investment proved lucrative by

compret CNG pipeline??? Bay Area Hub start with truck/rail 4000 psi LNG

the Wyoming fields to install compressed natural gas pipeline from the fields westward toward California. This investment proved lucrative by allowing industries beyond mining such as freight and logistics, manufacturing, and transportation to capitalize upon this energy source produced along the I 80 corridor.

Meanwhile, great advancement in the battery and electrical transferor technologies were being made. Essentially, large vehicles were able to effectively acquire electric energy in a routine matter throughout an operational cycle. These advancements provided the impetus for generating large-scale electrical mining equipment able to use the abundant resources of the Great Basin, sun, wind, geothermal energy. The legacy of the Great Basin pioneers and innovators lives on. By providing their own energy to fuel their economy, Nevada communities of the I 80 corridor continue to inspire with their innovation, self reliance and, resilience.



use maps to demonstrate how the technology explosions occur

use maps to help reader understand the corridor
Nevada tractors
oil and NG in Nevada "chain link shale"
independent in Nevada
Capital from big outfits
wildcat support

transformed in the ground
on vehicle
dump charge = high voltage quick charge (Reno)
mile frequency
South Korea induction chargeing w fixed route bus
NYC manhole shaped charger Beta/VHS

Land ferry

the new energy future

As I 80 communities in Nevada began to evolve as they passed into the mid-century. They began to feel the evolutionary forces of changing global dynamics. Globally, the increasing trend toward electric cars continues as fuel efficiency continues to increase. Around the world, renewable energy institutions continue to grow and mature as they evolve their delivery infrastructure. The innovators in state of Nevada begin to draw broad support for the implementation of the land fairy concept. This initiation has its greatest support among young adults in rural Nevada communities. They see this as both a job opportunity as well as enhanced access to global goods. Much of the discussion revolves around the most sustainable energy approach for the land ferry: traditional fuels, electricity, or something else. This discussion is attached to many other discussions around the world about the nature of energy when contemplating very long-term transportation infrastructure investments.

The use of alternative energy vehicles continues increasing during the 2030s. In response, Nevada communities continue investing and enhancing their alternative energy infrastructure to attract people invested alternative energy vehicle use. The entire effort is greatly enhanced by the continuing evolution of remote communications, both locally and throughout the world. Enhanced communications allows suppliers and users of alternative energy to better meet each other's needs in a more cost-effective manner. Essentially, many of the traditional marketing elements are removed by a near person-to-person communication network. Interestingly, friends and neighbors in these rural communities, working in the traditional mining industry began to see a potential advantage to investing in more homegrown energy than the continued import of fossil fuels. These different conversations during the 2030s in Nevada begin to lay the groundwork for some important future innovations.

Fundamental global dynamics begin shifting during the 2040s. Oil production and consumption began a long plateau in which they don't increase. Additional energy needs come from other sources. For example, electricity reaches 30% of global final energy needs. During the same time, Africa overtakes Europe and North America as the second-largest energy consuming continent, after Asia. By the end of the decade, world road passenger travel would triple that of 2012 levels. Communities in Nevada along the I 80 Corridor reflected many of these global shifts. The long-standing and continuously evolving alternative energy infrastructure network begins to draw national and global attention. The alternative energy network is mature and reliable providing strategic advantage for logistics and goods movement businesses. Global business decisions now begin to consider transport inventory that can capitalize on traditionally stable alternative energy supply chains. The land fairy concept continues drawing attention as these global businesses begin to contemplate business investments. In the state in Nevada, the land fairy is more than a concept with increasingly more detailed discussions about the initiative could be implemented. Traditional railroad infrastructure is nearly 200 years old.

World population reaches 9 billion of which 15% are elderly. While globally this population continues to urbanized, in rural Nevada they continue to figure out how to maintain their rural lifestyle. Enhance communication networks continue supporting and enhancing the rural lifestyle. Neighbors separated by 50 miles can feel virtually next door to each other enhanced high-bandwidth communication. Being able to communicate this way in rural settings changes the dynamics of rural lifestyle. Travel is more strategic and maximizes resource expenditures. The cost of living is more effective and the lifestyle more attractive. People adapt their lifestyles

and began pushing innovation frontiers. One frontier is the delivery of goods using drone devices: both air and land. The initiation begins as many do; in barns around rural Nevada and beyond. Farmers and ranchers began to experiment with drone devices that allowed them to engage in operational observations in a more efficient manner. Because of their interconnected network, they become very good rather quickly. Their success did not go unnoticed by potential larger operators. As Nevada approaches mid-century, many potentially significant innovations are in play.


**Nevada Scenario Based on Shell's Two Oceans**

**First-generation.**

By 2020, China is the number one consumer of oil in the world. Back in Nevada, which has no oil the focus is on to the production of renewable energy. Some of the worlds 400 GW of wind and 500 GW the photovoltaic can be owed to the innovation and entrepreneurship demonstrated by the people and communities occupying the vastness of the Great Basin. These individuals, communities, and businesses continue to evolve their system of self power generation statring and growing. Much of this is traced to the pioneering spirits of communities across the I 80 corridor in Nevada.

Beginning in 2014, Nevada communities began understanding their potential for generating renewable energy through wind, solar, and geothermal sources. A wealth of information is generated about renewable energy systems and access to this information continued increasing through connected communications. Local community leaders capitalized on this information to imagine their communities potential with renewable energy. This allowed these communities to start diversifying from their traditional mining economies. Some of the impetus for this diversification stems from the acquisition of NV energy by MidAmerican Energy. MidAmerican Energy is an energy firm with a focus on renewable energy production and distribution to meet state energy policy initiatives that enhance renewable energy. Working with state decision-makers, MidAmerican Energy brings together public-private partnership relations to generate the energy infrastructure to support the production of renewable energy including the communities along the I 80 corridor.



Additional impetus for this economic diversification in I 80 corridor communities stems from the grassroots effort to provide alternative energy infrastructure for transportation. Responding to the expanding alternative energy vehicle use in adjoining states and even Nevada, communities make it a priority to produce alternative energy infrastructure to support the travels of these vehicles. These initiative proves crucial in helping to diversify I 80 corridor community economies by incrementally improving local tourism opportunities. This enhanced energy infrastructure began with the strategic placement of type I recharging stations associated with businesses. These charging stations encountered ever-increasing use from an expanding range of vehicle types. Entrepreneurs take note and develop an alternative energy infrastructure franchise business model that allowes them to work with existing fueling stations and other businesses. The franchise model uses resources from government, energy sector, and other initiatives to induce local financial investment in alternative energy infrastructure. Key to the success of this franchise business model is the ability to continually update and maintain the wide range


of alternative energy fueling technologies.

During the 2020s, increasing global trends affect the local alternative energy production and distribution along the I 80 corridor. World production of electricity from natural grass reaches 2000 GW or a 40% increase over 2012 production. Coal is the number one global energy source. The Japanese reach 10% travel by electric or fuel-cell vehicles. World population reaches 1 billion while population in Europe is decreasing. Both Asia and Africa reach 50% urbanized population. At the same time communities along the rural I 80 corridor continue to struggle with providing the lifestyle younger generations seek. Continually enhance global communication provide younger generations with a sense of connection to global marketplace. Rural communities gain improved access global goods using enhanced communication and ever improving logistical support. Logistics businesses use this decade to reign in the uncertainty of energy costs within their business models. While freight continues to rely on fossil fuels including natural gas, the so-called last mile a delivery of logistics continue shifting towards the use of stable alternative fuels. Each logistics firm establish a mix of alternative fuels delivery vehicles that they feel best captures stable energy resources within their business model. This energy stability for their delivery greatly enhance their logistics capacity and ultimately their ability to deliver world products to rural Nevada communities.

What would eventually become the communities along the Interstate 80 corridor began millennia ago as geological tempests. As the land plates cooled and stretched over the western part of North America thinned crust experienced repeated up thrust that produce mountain range after mountain range. The Sierra Nevada, Rubies, and Wasatch mountain ranges are a few the majestic reminders of this geological history. This geological activity produce the fertile inter coastal and central valleys of California, as well as the Great Basin stretching from the eastern slopes of the Sierra Nevada Mountains all the way to the Rocky Mountains of Wyoming. The abundant gold and other precious mineral resources found in Nevada are the result of molten magna being pushed through cracks to the surface by ancient water 30 million years ago. Additional treasures include the open, majestic, pristine vistas and wealth of unique natural flora and fauna resources second only to Hawaii in diversity.

In this beginning of the natural flora and fauna were the peoples of the Great Basin: the Paiutes, the Shoshone and the Ute. Paiute clans settled by enduring sources of water and were named for their primary food source. The Shoshone and Ute shared the naming convention as they traveled as clans around portions of the Great Basin. Pinion nuts, water reeds, ground squirrels, among other resources provided the peoples of the Great Basin with a lifestyle that cherished and existed in harmony with nature.

The communities along the I 80 corridor often owe their original settlement to the travelers across the Great Basin. A Google map tells us a trip from San Francisco to Cheyenne should take 18 hours at 75 miles an hour. Historically, humans living and traveling through the Great Basin through time met challenging hardships of sparse water resources, great distances, and often unyielding weather. Communities of the I 80 corridor have historically and continue to help with people's desire for travel. This is the human spirit for the California trail, the transcontinental railroad, the Lincoln Highway, United States Route 40, the modern day Interstate 80.

The I 80 corridor communities continue embracing the historical spirit of life in the Great Basin and Columbia Plateau. Rural Nevada communities exemplify the resilience, the resourcefulness, and the ingenuity that continuously provides these communities with human energy necessary to succeed. The Nevada homestead tractor provides one example of these characteristics. Fuel for farm machinery was expensive and heavy requiring considerable effort to transport to remote homestead locations. In order to get the most benefit from these efforts, homesteaders would construct large flywheels that would maximize the amount of work each ounce of fuel could produce on the homestead. These unique farm machines are still on display today as source of pride of heritage.

Elko has spent decades with the open pit mining-based economy. Fortunes rose and fell based upon the price of gold and other minerals. The economy of Northeastern Nevada proved relatively stable through this time because of the worldwide desire for gold and other precious minerals. This is true even of the Great Recession of 2007-2008. The local economy, like economies all over the world was affected by the retraction in construction and development. They struggled with workforce housing but overall weathered the recession pretty well. While the local economy remains strong, it also remains reliant upon the import of energy to support the booming mining economy.



Future

Families throughout the Northeast Nevada were dealing with the many different changes during the early decades of the 21st century in the Western United States. Those dedicating their lives to the mining profession believe the current practices of the international mining conglomerates would continue to provide prosperity for the communities. Others of the younger generation with the opportunity to attend Great Basin College began to think about other potential futures. Many of these thought that the natural treasures of the Great Basin, abundant sunlight, accessible geothermal, and the ever present wind

might prove to be an even more important potential self reliant source of energy in the future.

Mining precious minerals requires a particular market price for the minerals and the ability to obtain those minerals while achieving a return on investment. A big component of the investment cost is energy to power the massive mining equipment and other production facilities. Just like the original pioneers of the Great Basin, these present-day innovators sought new ways of providing sustainable energy to fuel the economy. At the same time, significant movements were advancing the state-of-the-art in electric vehicle and other alternative fuel technologies such as compressed natural gas and hydrogen. These trends would provide the impetus for the evolution of self reliant energy for the I 80 corridor.

The shale formations in Wyoming were producing significant amounts of natural gas. Students a Great Basin College were studying engine technology with a focus on diesel engines. They experienced an ah ha moment in their research when realizing with adjustments they were able to modify the large diesel engines of mining equipment to utilize compressed natural gas. These innovations motivated CNG producers in the Wyoming fields to install compressed natural gas pipeline from the fields westward toward California. This investment proved lucrative by allowing industries beyond mining such as freight and logistics, manufacturing, and transportation to capitalize upon this energy source produced along the I 80 corridor.



Meanwhile, great advancement in the battery and electrical transferor technologies were being made. Essentially, large vehicles were able to effectively acquire electric energy in a routine matter throughout an operational cycle. These advancements provided the impetus for generating large-scale electrical mining equipment able to use the abundant resources of the Great Basin, sun, wind, geothermal energy. The legacy of the Great Basin pioneers and innovators lives on. By providing their own energy to fuel their economy, Nevada communities

of the I 80 corridor continue to inspire with their innovation, self reliance and, resilience.