

Powering San Joaquin Valley Sustainable Economic Development

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Macpherson Energy Corporation

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Macpherson has operated oil production in Kern County since 1973.



The Cogeneration Plant was constructed at an oilfield in 1987.

MACPHERSON

OIL COMPANY

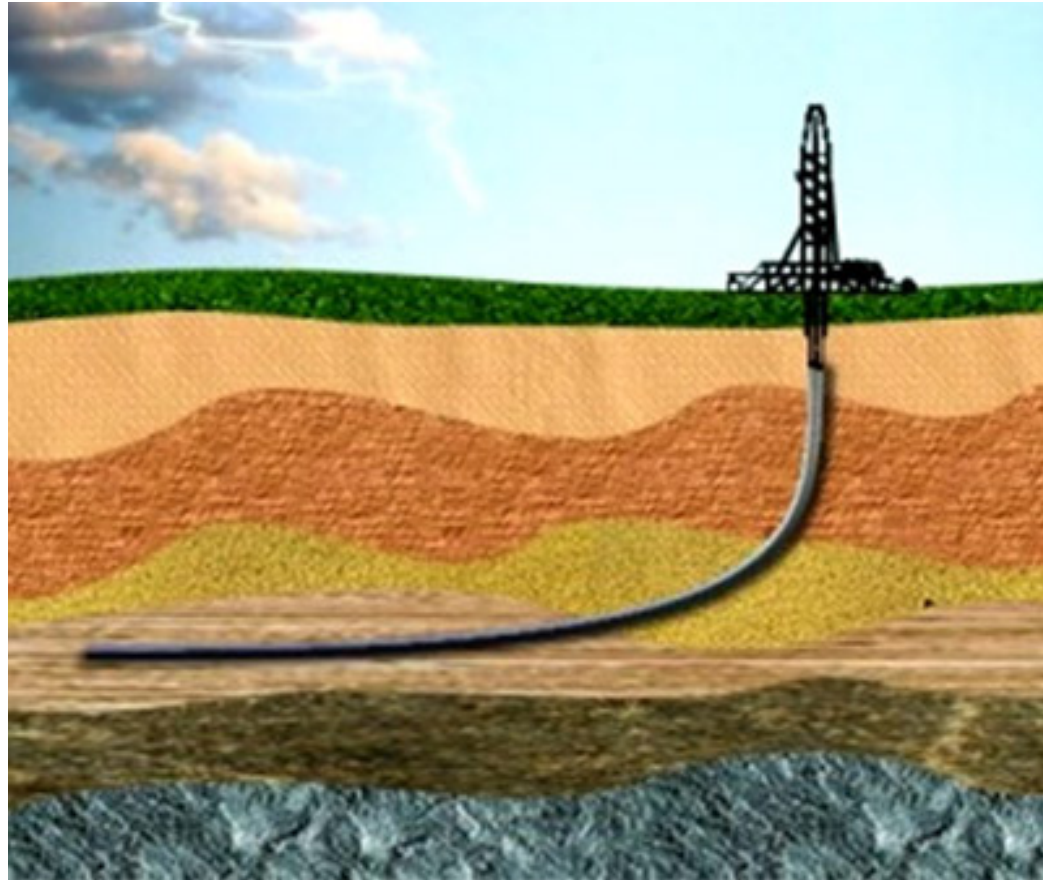
Round Mountain Unit

Sec18 T28S R29E

CACA 34219X

Round Mountain Field 1996

Horizontal Drilling



The plant converted to renewable biomass in 2011.



Solar Field



Dramatic Changes in Energy Business

Old field Technology

- ▶ Enhanced oil recovery
- ▶ Horizontal Drilling

Electricity Generation

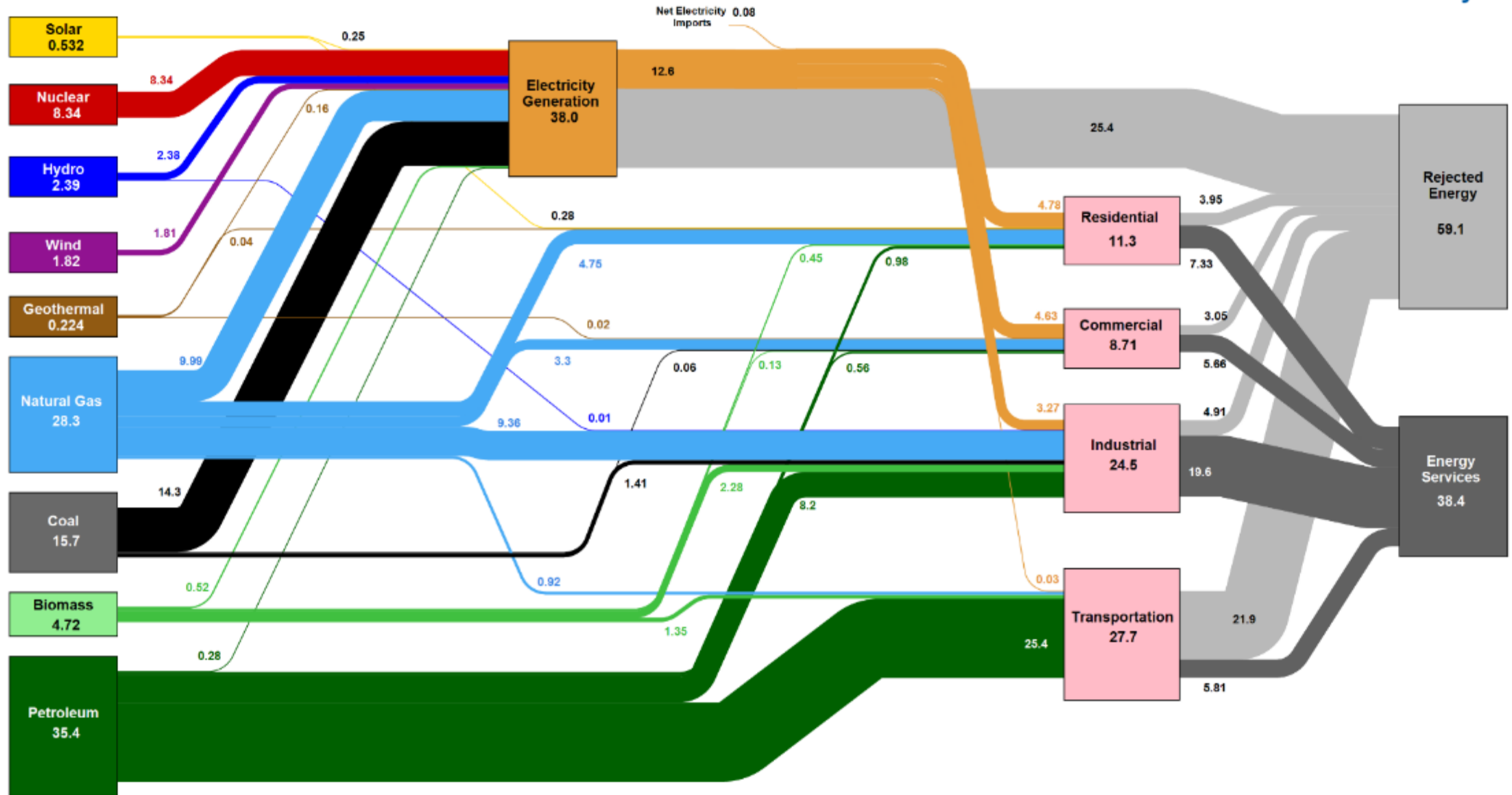
- ▶ Deregulation of the electric business
- ▶ Clean coal to renewable biomass

Locational Opportunities & Challenges

- ▶ Close to the markets
- ▶ Interaction with AG/Water/Transportation/Urban



Estimated U.S. Energy Consumption in 2015: 97.5 Quads



Source: LLNL March, 2016. Data is based on DOE/EIA MER (2015). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant heat rate. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential sector, 65% for the commercial sector, 80% for the industrial sector, and 21% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Workforce Characteristics

1. Offices have moved from managing information flow to analytics
2. Technology advances are enabling step changes in productivity
3. Field has moved from roughnecks to safe and reliable technicians
4. Key issues: Integration of activities/ Complexity of roles / Team Skills in automated and digital workplace

Impacts on Education

1. Safety/Regulatory Responsibility is a must
2. Technical Skills - Need to be used for Problem Solving in a team
3. Interpersonal Skills - need for soft skills in a complex environment
4. Continuous Learning - the foundation for career agility

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