



# CHP: Clean, Efficient Energy for Today's Business and Tomorrow's Opportunities

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# Outline

- **Why Combined Heat and Power (CHP)?**
- **Chevron and Energy Efficiency**
- **CHP Solutions for Today's Business and Tomorrow's Opportunities**
  - **Enhanced Oil Recovery**
  - **Non-Conventional Geothermal**
  - **CHP & Biomass Facilities**
  - **Hydrogen Fuel Cell Cogeneration Plant**
- **Conclusions**



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# Why Combined Heat and Power ?



- Energy Efficient
- Environmentally Friendly
- Reliable Power/Quality
- Economic
- Locally Produced
  - Reduced line losses
  - Emergency supply



# Chevron and Energy Efficiency

- Long history of CHP experience
- Over 50 CHP units (installed primarily at Chevron refineries, oil and gas operations, and Joint Venture power facilities)
- Chevron power generation approx. ~7 MW (~40% is CHP)
- Additional CHP projects being considered worldwide
- Since 1992, we have increased the energy efficiency of our global operations by 27% and lowered annual energy costs by approximately \$2 billion
- CO2 emissions reduced

# Chevron Enhanced Oil Recovery – Bakersfield, CA



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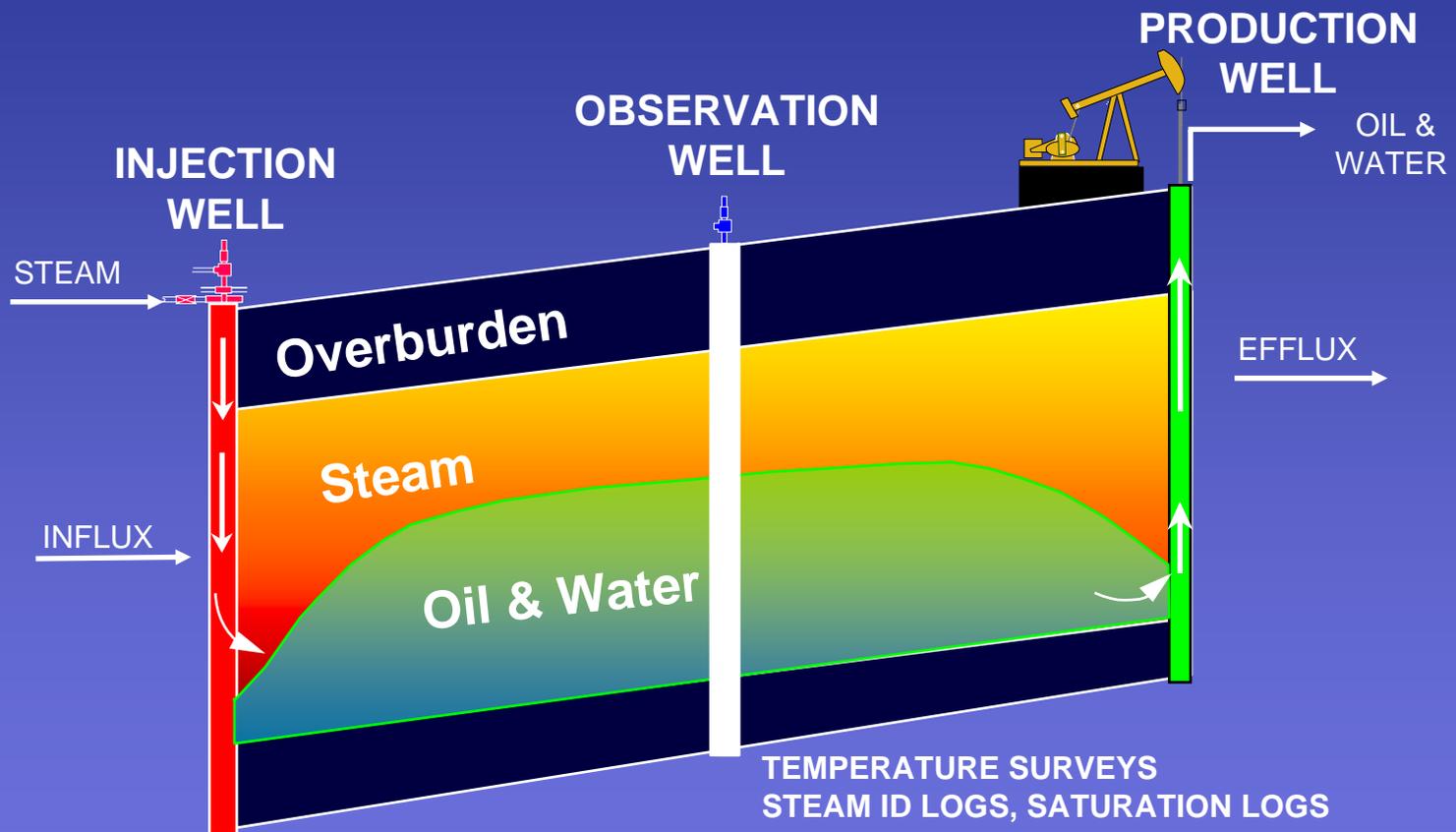
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# Pumping “New Life” from Old Oil Fields

- Discovered in 1899, the Kern River oil field peak production was 25 years ago
- Production declined 3 - 4% each year since
- Heavy crude oil 600 - 1000 feet below ground
- Millions of gallons of steam are injected into the field to melt the oil, which is thick like molasses
- Chevron is one of the leading pioneers in developing heavy oil recovery
- Can now extract 80% of the oil in some reservoirs, compared with 15% before steam injection was introduced

# Typical Thermal Reservoir Management



# Non-Conventional Geothermal (waste heat recovery from produced fluids)

- Worldwide, Chevron produces millions of barrels of hot fluids (oil, water, gas) from existing oil and gas operations
- Emerging heat mining technology is available to convert this unused heat resource into power
- Direct benefits include offsetting operating costs and increasing revenues through export power sales
- Source of renewable power reducing carbon footprint and contributes to meeting AB-32 objectives (CA)



# Santa Rita Jail Fuel Cell Power Plant – County of Alameda, CA

## Chevron Energy Solutions

- First megawatt-class fuel cell in California
- Ultra-clean, ultra-low emissions, quiet operation
- Involves no combustion
- Heat recovery increases efficiency by capturing exhaust heat for water and space heating inside jail
- Reduces power purchases by 80% during peak-demand summer months



# Kitchen Grease Powers Wastewater Treatment Plant – Milbrae, CA

## Chevron Energy Solutions

- New 250-kilowatt natural gas (methane) and biogas-fired microturbine generator system
- Includes fuel treatment, blending facility and new grease receiving station
- Encourages responsible grease disposal
- Reduces greenhouse gas emissions
- Self-funding
- Efficient use of taxpayer dollars





## In Closing

**Chevron views CHP as an opportunity that governments should be leveraging by**

- **Recognizing and promoting the value of CHP in reducing grid congestion and emissions**
- **Supporting policy and regulation to help foster new CHP project developments**