# Chevron's Business-Driven Actions on Greenhouse Gas Emissions Management

California Climate Action Registry
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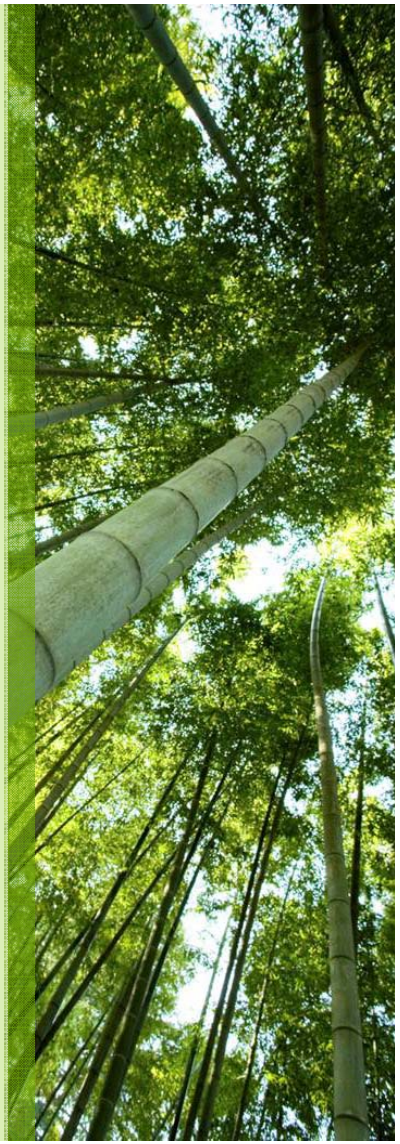
# Outline

## What is Chevron doing?

- 7 Principles and 4-Fold Action Plan
- Capital Project Planning
- California Projects
- Biofuels/Alternative Energy
- Public Engagement

## Operations and Emissions

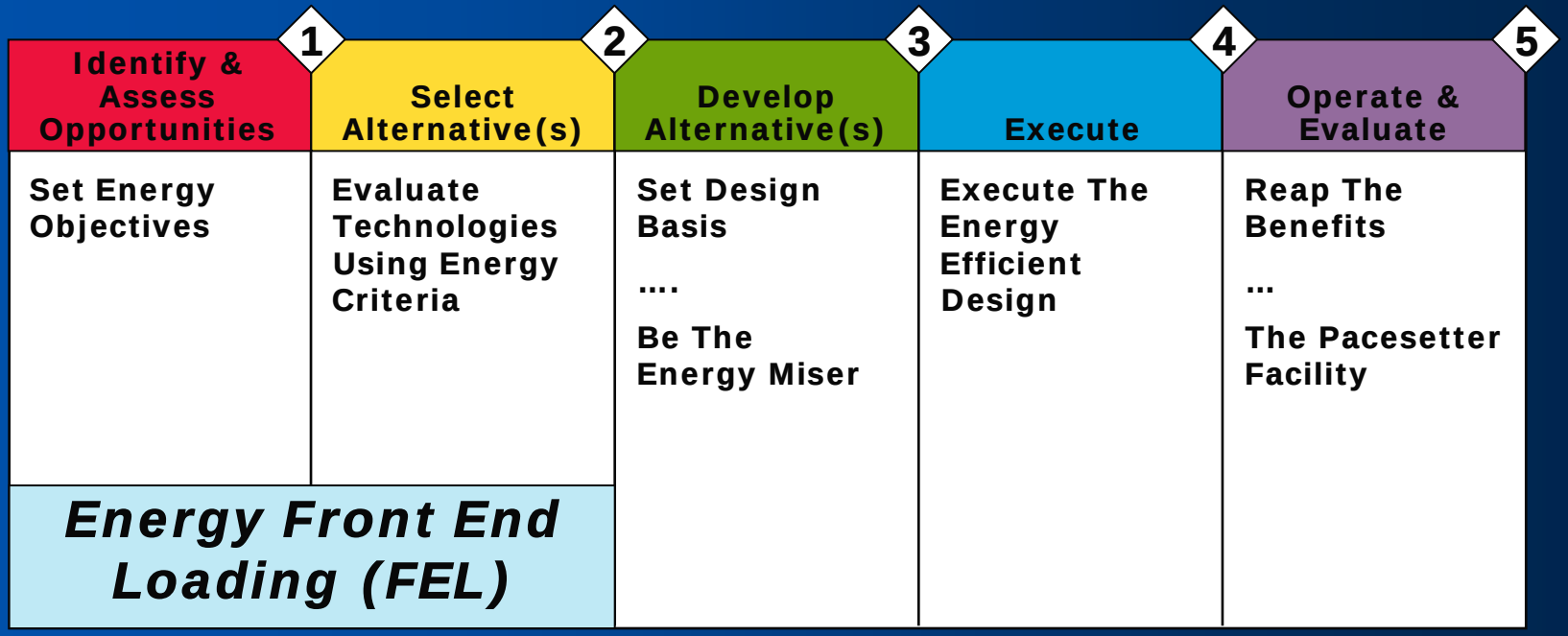
- Progress made to date
- California refining's challenges
- Why Cap and Trade is best approach



# Energy Efficiency For Capital Projects

## Capital Projects Offer the Best Opportunity for Efficiency Improvement

- Ensure Project Teams have a clear message that the Energy Efficiency of the project is a Strategic Objective early in the project
- Provide the organization's Energy Efficiency Guidelines, if available, for capital projects for the site or business unit
- Use the Energy Efficiency Value Improving Practice for Capital Projects



# Chevron Energy Solutions

## Example: San Jose Unified School District

- Largest solar and energy-efficient facilities project in K–12 education in the U.S.
- $25 MM in energy cost savings to District
- CES will design, build, operate and maintain 5 MW of solar arrays, including M&V and guarantee
- Bank of America will own solar equipment and sell power to District at below-market utility rates
- Phase I completed in August

# Chevron Technology Ventures
## Renewable Energy Systems

### Solar Mine Project in the Midway-Sunset Heavy Oil Field

***Renewable energy systems integrated into oil field operations***

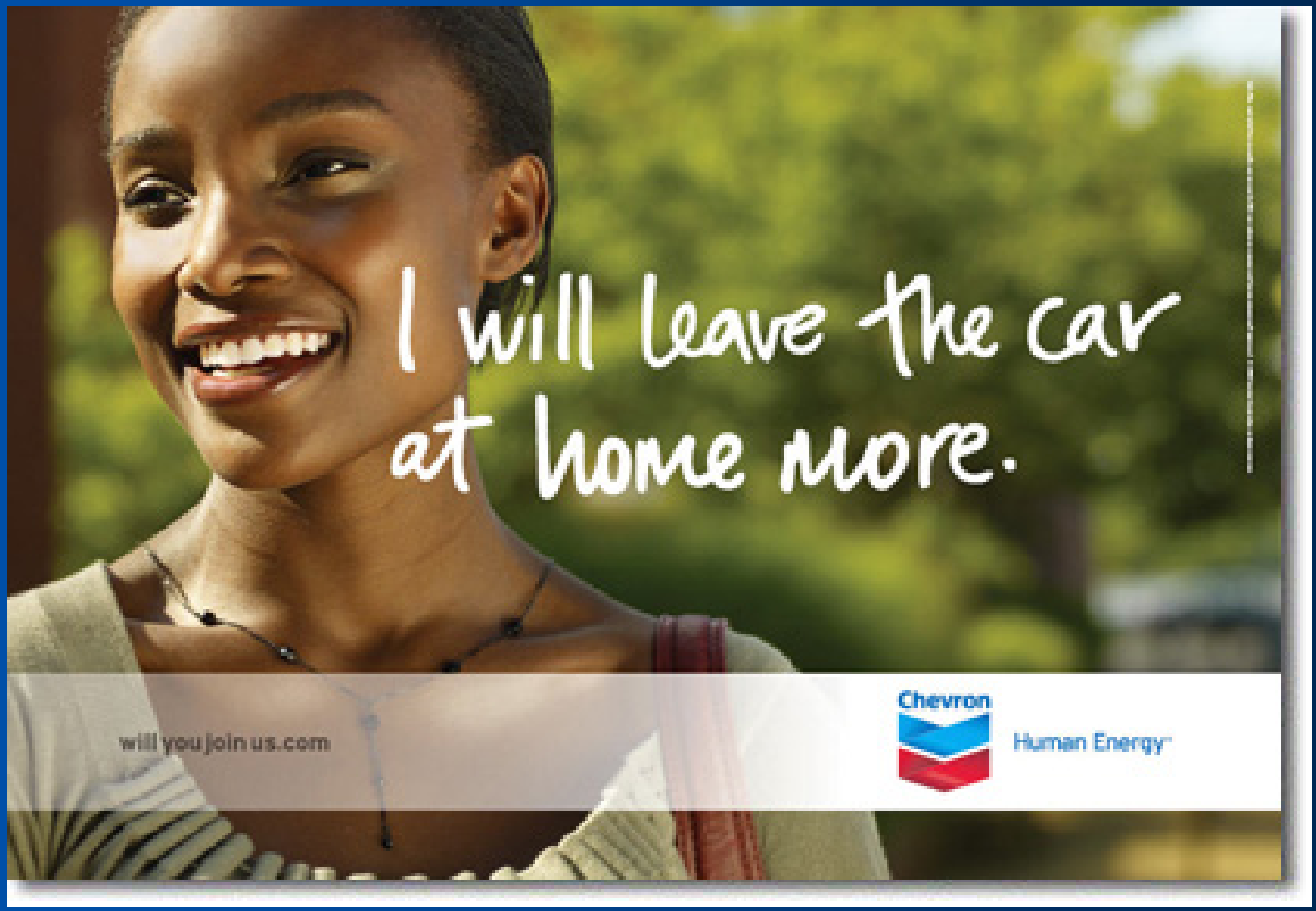
# Investing in R&D: Second Generation Biofuels

- Biofuels will play an increasingly important role in meeting the world's growing energy needs and diversifying energy supplies.
- Chevron is well-positioned to make significant contributions to the evolving biofuels industry.
- Second-generation biofuels – those made from cellulosic, non-food feedstocks — hold the greatest promise to grow the biofuels industry to large scale.
- Chevron is actively working and investing to accelerate the scientific, technical, and commercial breakthroughs necessary to bring second-generation biofuels to large-scale commercial production.
- Bringing biofuels to large-scale commercial production is an enormous challenge that will be achieved only through collaboration.

# Other Chevron Alternative Energy Activities

- Chevron's current renewable and advanced energy - Large installations:
  - Geothermal: Chevron is the largest producer of geothermal power with over 1250 MW in Indonesia and Philippines, with expansion underway
  - Solar PV: 500 kW system in central California oil field, and other smaller installations
- Chevron Energy Solutions engaged in numerous energy and efficiency projects involving molten carbonate fuel cells, solar PV roofs, advanced lighting, and energy saving cooling and heating systems for buildings
- Renewable energy opportunity development, including a major second generation cellulosic biofuels R&D program – Also ocean energy, solar and wind projects (Chevron Technology Ventures, Energy Technology Company, Chevron Global Power Generation)
- Strategic research projects: solar thermal, solar $H_2$, waste heat to power, carbon fuel cells, $CO_2$ capture and sequestration, biofuels, biolubricants (Energy Technology Company)

# Public Engagement: “I Will”



# Operations and Emissions

## $CO_2$ and Methane Emission Sources


### Sources

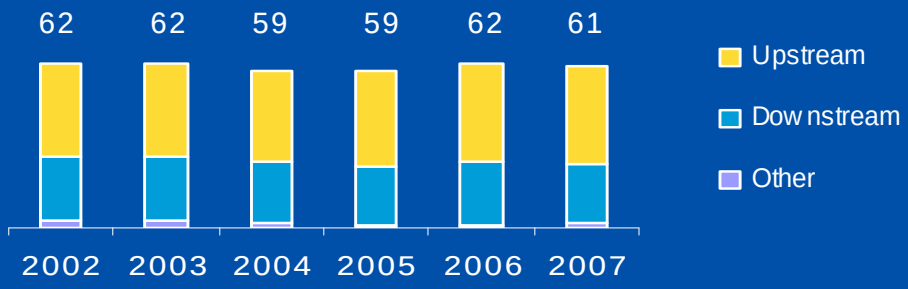
| Production | Transportation | Refining and Petrochemical Production | End Use |
|---|---|---|---|
| ■ Combustion and rotating equipment, flaring, venting | ■ Pipelines | ■ Heaters | ■ Customer use of gasoline, diesel, and coal |
| ■ Gas associated with oil production | ■ Vessels | ■ Boilers | |
| | ■ Vehicles | | |

### Emission

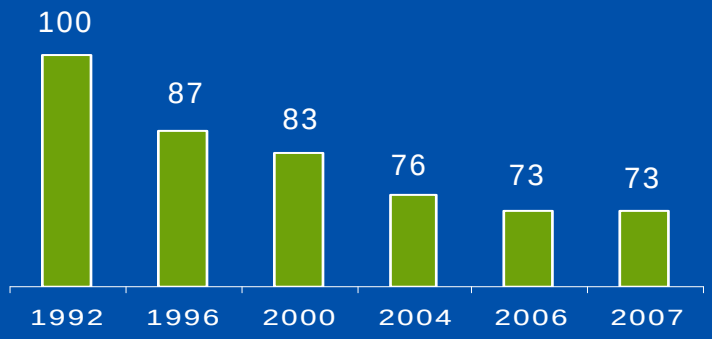
| Production | Transportation | Refining and Petrochemical Production | End Use |
|---|---|---|---|
| ■ $CO_2$<br>■ Methane | ■ $CO_2$<br>■ Methane | ■ Primarily $CO_2$ | ■ $CO_2$ |

# Progress Towards Reducing GHG Emissions

Greenhouse Gas Emissions
(Million Metric Tons $CO_2$ Equivalents)




Chevron Energy Index (CEI)




**Note:** 2002-2006 Equity share emissions do not include ChevronPhillips Chemical and Dynegy. "Other" includes shipping, power & gasification, coal & corp. services.

- Greenhouse gas emissions accounting has become standardized
  - Chevron-developed SANGEA™ software has the key role
- Chevron energy efficiency improved 27% from 1992
- US refineries plan an additional 10% emissions reduction by 2012 via API commitment
- Chevron is taking steps to reduce international venting and flaring of remote gas
- EE is integrated into capital planning at the front end of project development
- GHG is also part of major capital planning

# Results: CA refineries are some of the most energy efficient globally

- CA refineries are some of the most energy efficient in the world.
  - Product slate (cleanest burning fuel in the world)
  - Utilization rates (up to 95% utilization)
- URS 2007 report to the Bay Area AQMD on "Opportunities for GHG Emission Reductions at Stationary Sources" concludes limited size and number of energy efficiency gains.
  - NOx rules already require optimized performance of furnaces and boilers.
  - Efficiency improvements around 0.5-1%
- We expect that further energy efficiency in CA will be very limited in size and number.

# Cap and Trade is Best Approach to Drive Refinery Emissions Reductions

- Each refinery is unique
  - What works in one may not work in another
  - Configurations, layout, space restraints, operating restraints and capital constraints are key factors
- Must consider competing goals
  - Existing requirements may limit opportunities for GHG reductions
- Permitting hurdles will likely be significant
- New technologies are limited

A C&T program will incent facilities to look for emissions reductions in each facility's specific configuration.

# Long and Very Long-Term GHG Mitigation Technology Landscape

- Carbon Capture and Sequestration (CCS) technology has important role, but has hurdles
  - Technology needed to yield cost reduction for broad use
  - Regulatory and legal issues need to be discussed and resolved
- Driving down the cost of renewables and other emerging technologies
  - Solar cells, wind turbines and biofuels costs remain prohibitive
- The R&D community is also investing into “Plan B” technologies
  - Space-based solar cells, nuclear fusion, and high-altitude wind are very far away from reality