



Shell and Alternative Fuels

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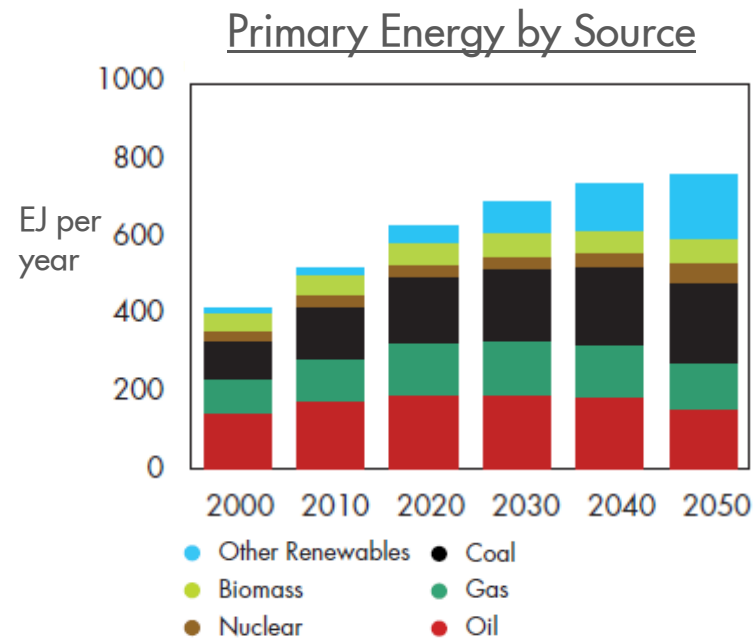
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WORLD DEMAND FOR ENERGY IS GROWING FAST

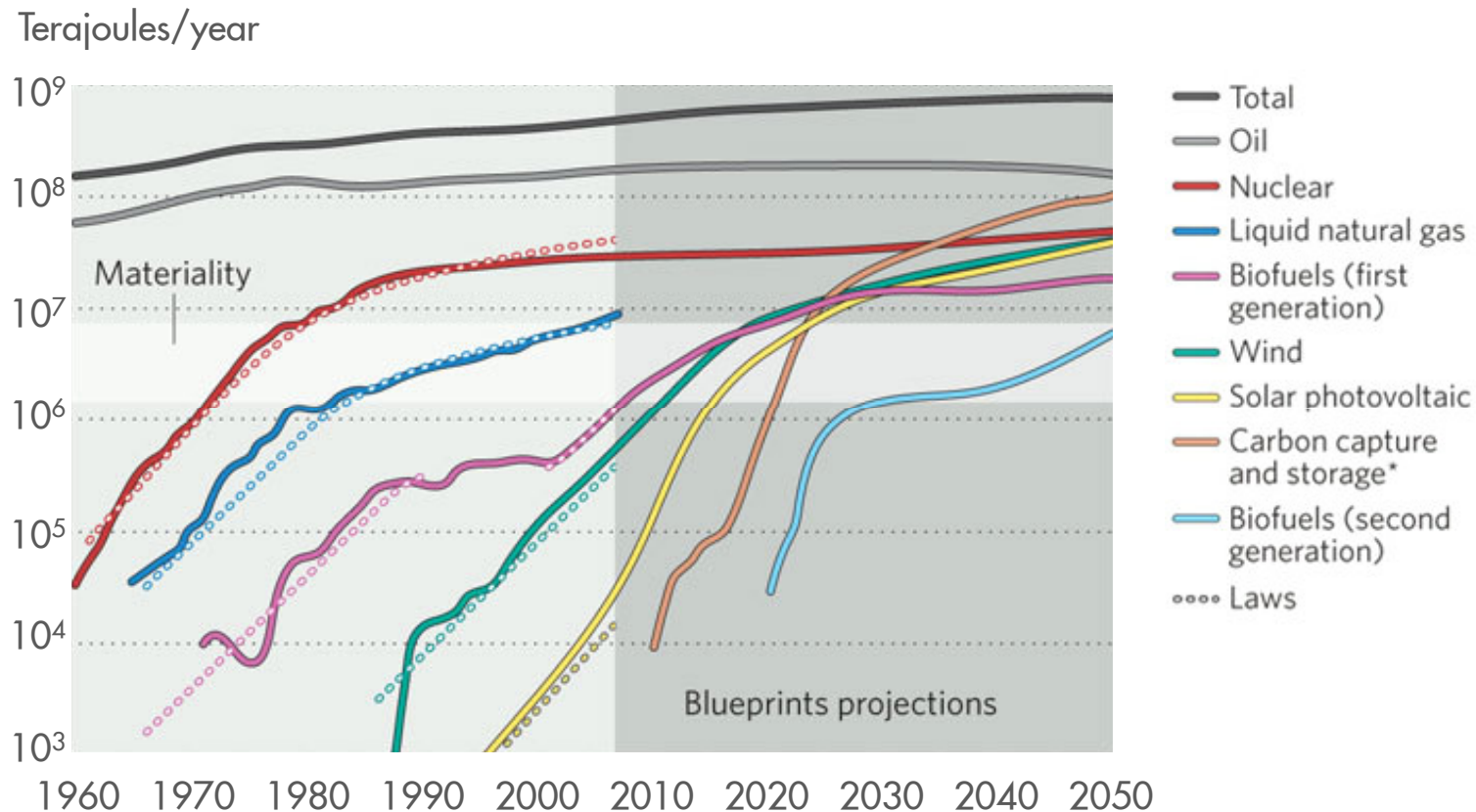
- Population growth and economic development could double energy needs by 2050
- The mix of energy sources will change gradually



Source: Shell Scenarios/IEA

ENERGY TECHNOLOGY CHANGE TAKES TIME

Global production of primary energy sources.



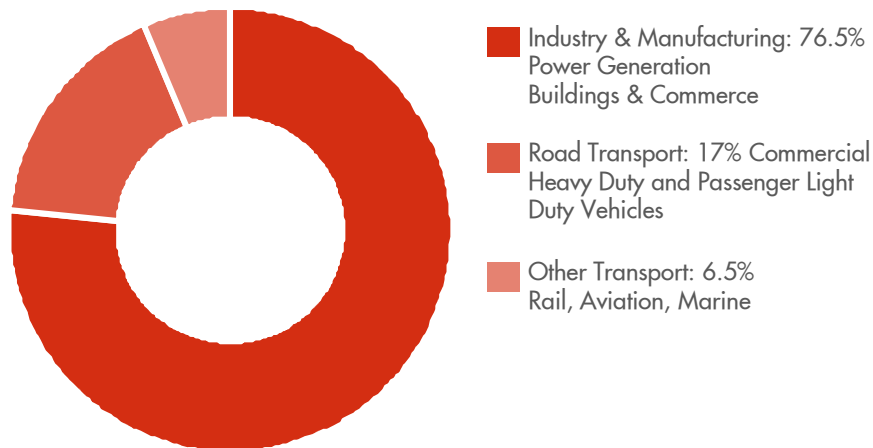
Source: Historic Data: Energy Balances of OECD Countries (IEA, 2009), Energy Balances of Non-OECD Countries (IEA, 2009). Projections: Shell International, from the article: *No quick switch to low-carbon energy* by Gert Jan Kramer & Martin Haigh *Nature* 462, 568-569(3 December 2009)

*Coal and natural gas used in power generation with carbon capture and storage

TRANSPORT ENERGY DEMAND WILL INCREASE RAPIDLY

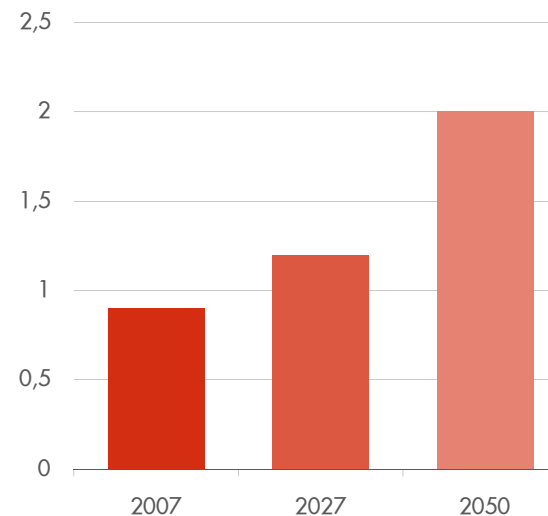
- Transport accounts for about 23% of *energy-related* CO₂ emissions. Road transport accounts for 17%
- Global population is growing and demand for mobility is increasing
- The number of vehicles on the road is expected to double to more than two billion by 2050

Energy Related CO₂ Emissions*



Source: International Energy Agency
* 62% of global CO₂ emissions

Estimate of worldwide vehicle demand



Source: World Business Council for Sustainable Development 2007

NO SINGLE ALTERNATIVE TO OIL BASED ROAD TRANSPORT

- All fuel options will be needed
- Countries and regions will choose portfolios of fuel solutions based on cost, security of supply, existing infrastructure and CO₂ emissions
- Not just fuels: Improvements in CO₂ emissions through vehicle efficiency, fuel technology and driving habits
- The internal combustion engine and liquid fuels will continue to play an important role
- Electric and hydrogen will play an important role if technical and infrastructure challenges can be overcome
- Natural gas will continue to find a niche in local markets

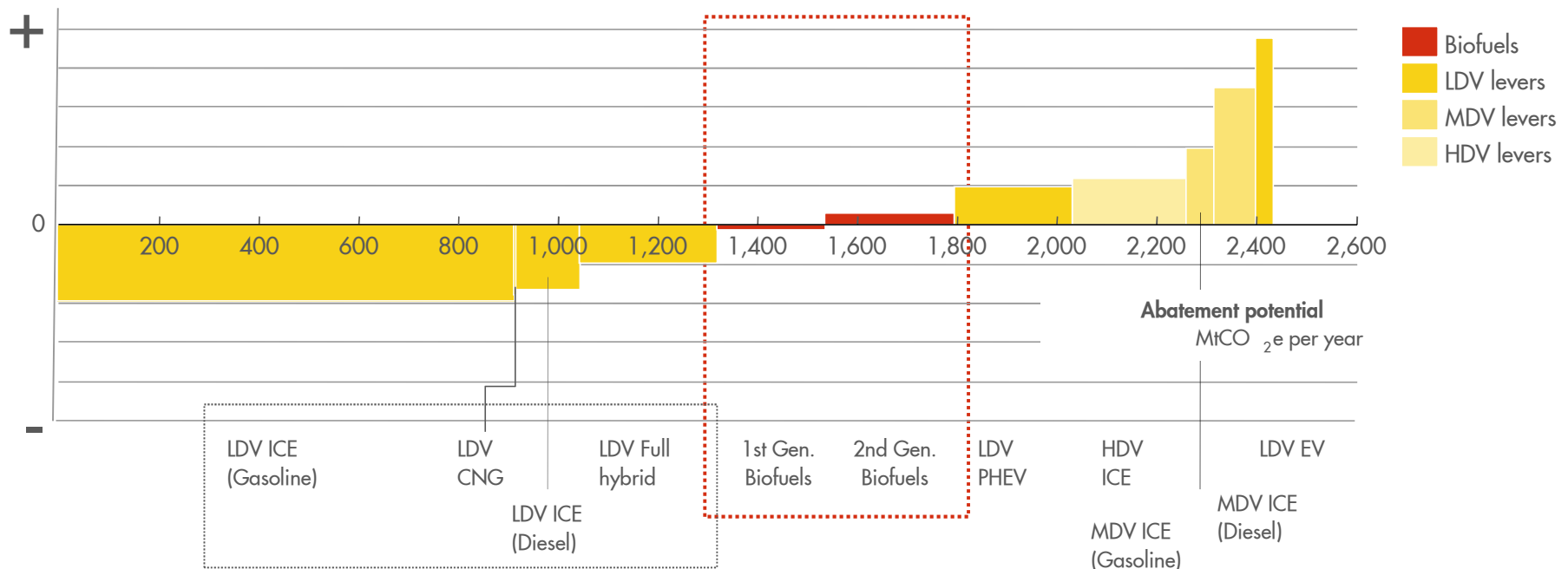


BIOFUELS AND EFFICIENCY: REDUCING CO₂ EMISSIONS TODAY

- Today's biofuels are a realistic commercial solution to reduce CO₂ in the transport fuels sector over the next twenty years

Global CO₂ abatement cost curve for the Road Transport sector - Mix Technology World scenario
Societal perspective; 2030

Relative abatement cost



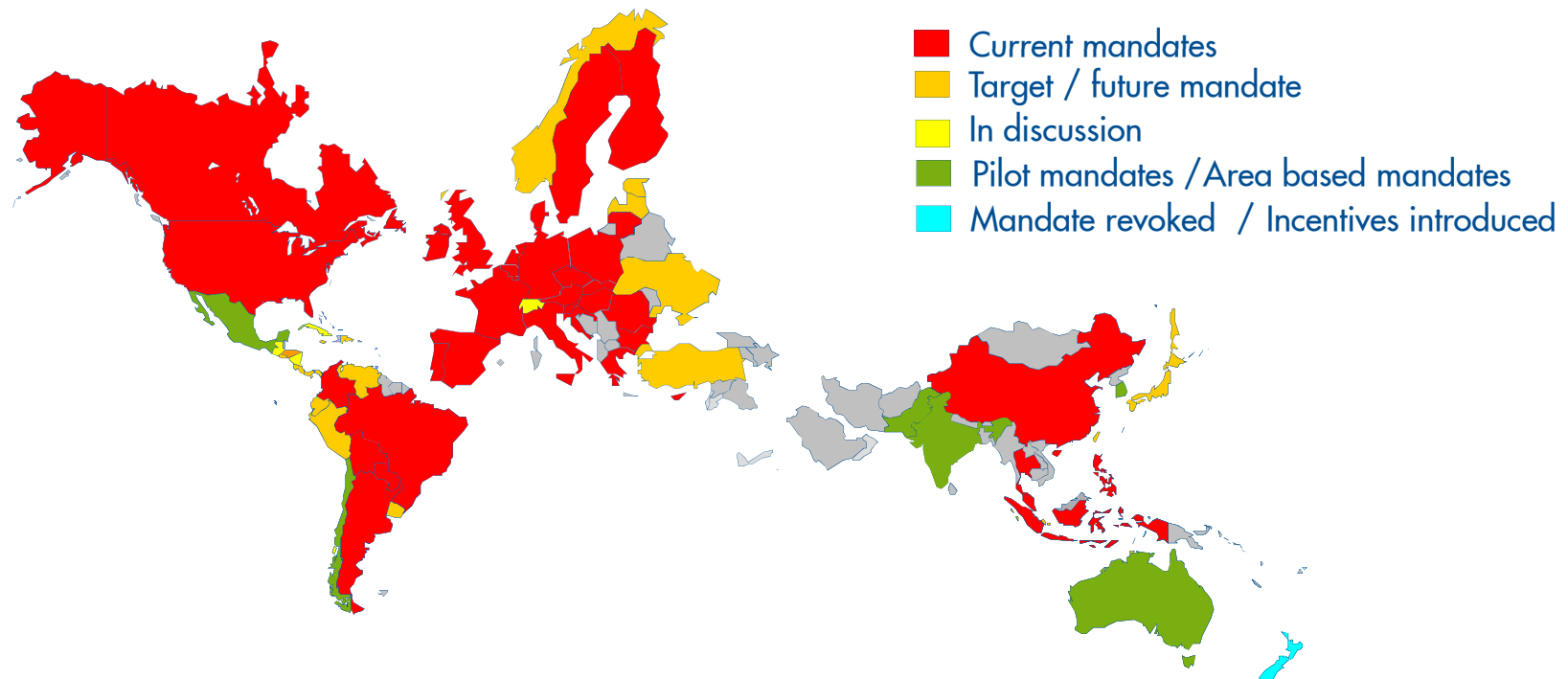
Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €100 per tCO₂e in a penetration scenario if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.

Source: Global GHG Abatement Cost Curve v2.0

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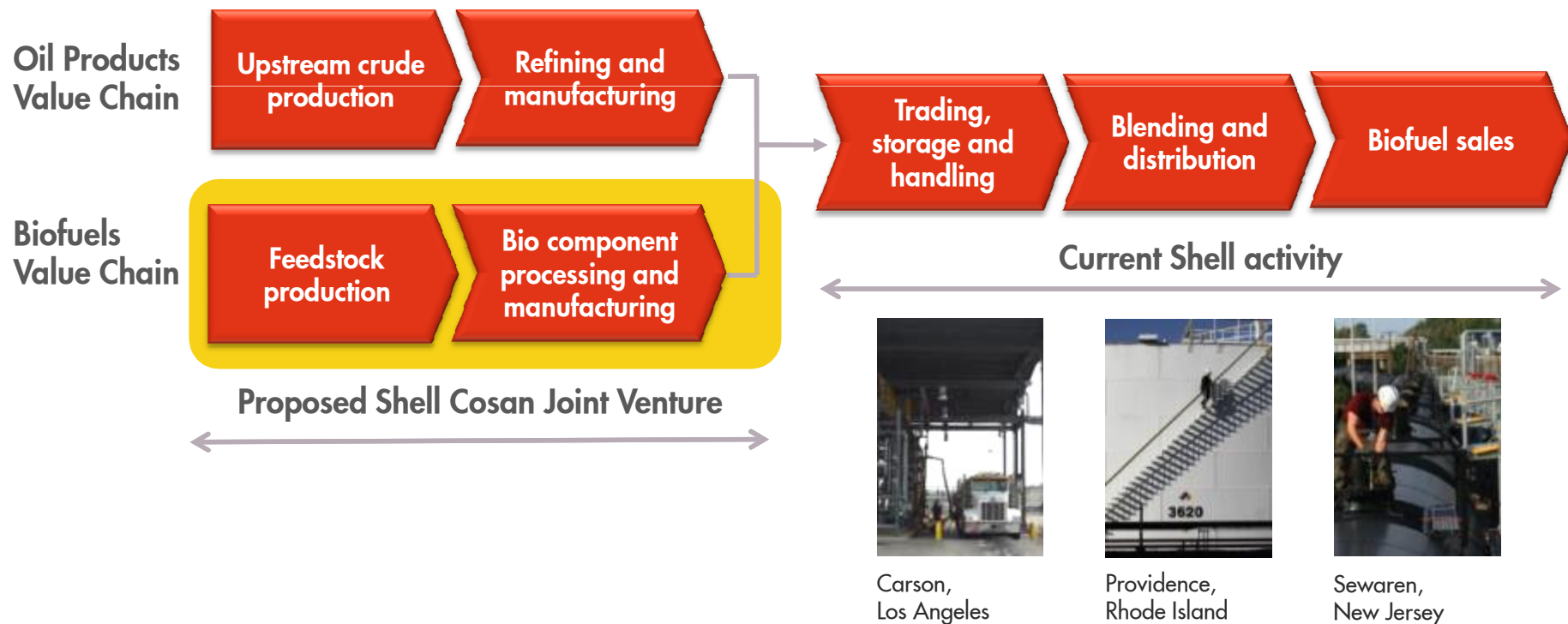
GOVERNMENT POLICIES CREATE A MARKET FOR BIOFUELS

- Legislative priorities differ – energy security, support for domestic agriculture, environment
- Policies have created an international market for biofuels. Shell is working to meet obligations & benefit from opportunities
- The International Energy Agency has estimated that biofuels could represent 30% of the world's road transport fuel mix by 2050



SHELL: A LEADER IN TODAY'S BIOFUELS

- 30-year history of biofuels development and investment
- Growing investment in infrastructure to store, blend and distribute biofuels
- World's largest distributor of biofuels – 9 billion litres in 2010
- Building capacity in biofuels that provide best combinations of performance and low 'well-to-wheel' CO₂ performance from more sustainable feedstocks



PROPOSED SHELL COSAN JOINT VENTURE

- Brazilian sugar cane – lowest CO₂ most sustainable and cost competitive of today's biofuels
- Proposed \$12 billion joint venture with Cosan
- 2 billion litres of ethanol production capacity per year – with room to grow
- Robust sustainability principles, standards and operating procedures

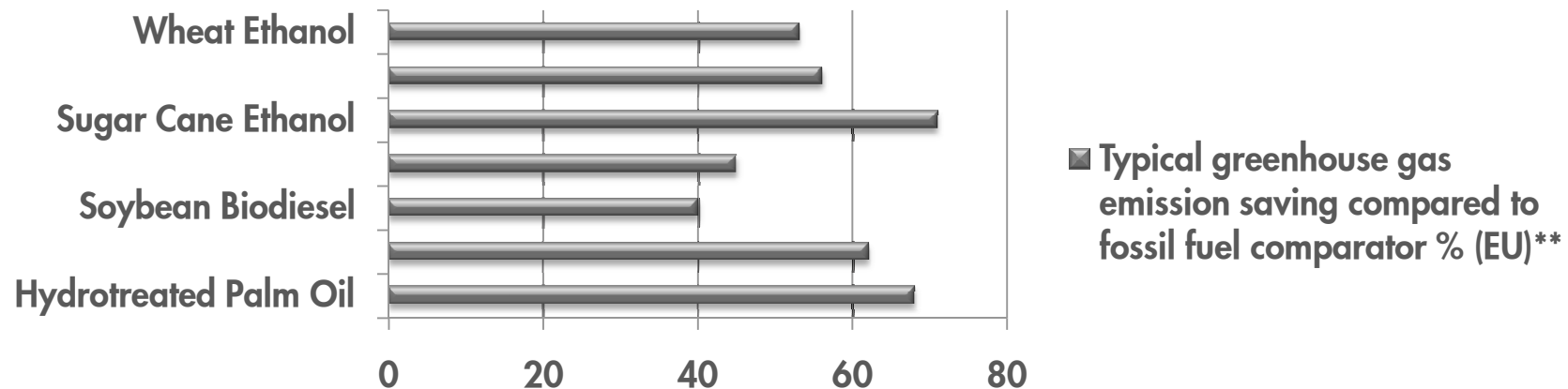


Automated sugarcane harvesting



BIOFUELS REDUCE CO₂ TODAY AND DIVERSIFY FUEL SUPPLY

- Biofuels are a low 'well-to-wheel'* CO₂ sustainable alternative to gasoline and diesel available today
- But CO₂ emission reductions depend on whole journey to combustion – feedstock production, process used, distribution and use in vehicles
- Biofuels diversify transport fuel pool and offer prospect of improved energy security
- Biofuels can be used in existing liquid transport fuel infrastructure
- For some countries biofuels can offer economic and rural development opportunities



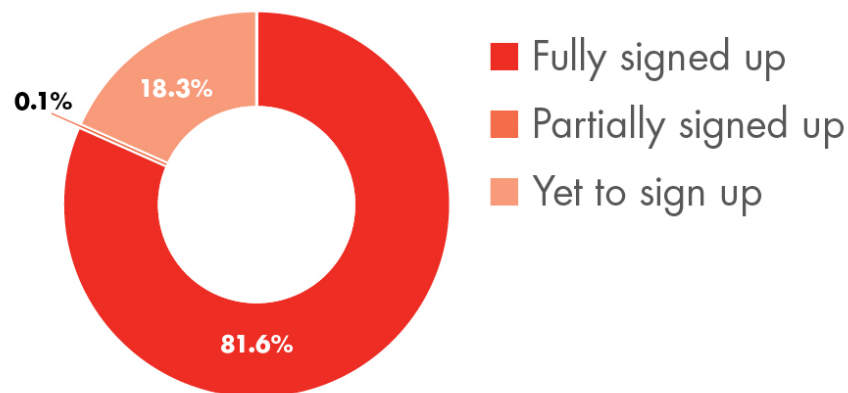
*Well-to-Wheel CO₂ analysis calculates the CO₂ emissions relating to a particular fuel pathway. The calculation divides the pathway into two parts: (i) 'Well-to-Tank' (WtT) CO₂ emissions – from the production and distribution of the fuel feedstock and the actual fuel (ii) 'Tank-to-Wheel' CO₂ emissions – from the use of the fuel in the vehicle

** Directive 2009/28/EC of the European Parliament and of the Council

SUSTAINABILITY OF SHELL'S BIOFUELS SUPPLY CHAIN

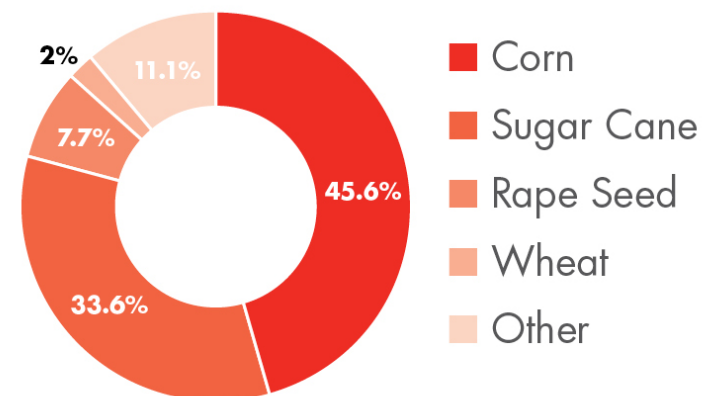
- Championing sustainability standards in our own biofuels supply chain
- Rules and practices to help assess risks, implement controls, monitor compliance and report our progress
- Sustainability clauses in new and renewed term contracts:
 - feedstocks not knowingly linked to violation of human rights or produced in areas of high biodiversity value
 - suppliers develop and implement supply chain traceability systems
 - suppliers join relevant international bodies developing sustainability criteria particular feedstocks

Shell's Biocomponent Purchases Covered by Sustainability Clauses



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Shell Global Biocomponent Feedstock Purchase Q4 2009



HYDROGEN FOR TRANSPORT

- Hydrogen is used in hydrogen fuel cell vehicles that produce electricity
- Hydrogen's contribution to reducing CO₂ emissions depends on how it is produced
- Important role as one of the small number of options to diversity road transport fuel
- Development is longer term – rapid expansion after 2025
- Requires new vehicles and new dispensing systems
- Currently 95% of hydrogen is produced from natural gas or by gasifying coal.
- Future low CO₂ options include biomass and electrolysis using renewable electricity



SHELL AND HYDROGEN

- Through partnerships Shell currently provides stand-alone, demonstration hydrogen filling stations.
- These stations provide us with important experience in consumer behavior, safety, cost, and the dispensing and storage of hydrogen.
- Numbers will change as new stations are developed and existing stations come to the end of their demonstration phase.
- Shell also has a research programme into future low CO₂ hydrogen options.



Los Angeles, USA



Tokyo, Japan

THE FUTURE FOR HYDROGEN IS COLLABORATION

It will take considerable cooperation between car makers, fuel suppliers and governments for hydrogen to fulfill its potential.

Car makers

- Shell works in collaboration with car makers to develop demonstration hydrogen filling stations.

Shell is involved in a range of private / public partnerships

- California Fuel Cell Partnership
- Japan Hydrogen and Fuel Cell Demonstration project.
- European Union Fuel Cells and Hydrogen Joint Technology Initiative
- H2Mobility in Germany

Academic Institutions

- Shell has research partnerships with a range of universities.



GTL GASOIL

- GTL gasoil is an alternative diesel fuel which will contribute to the diversification of the diesel fuel supply
- GTL gasoil is a cleaner fuel, non-toxic, biodegradable, free of sulfur and aromatics. It has a cleaner burning than conventional diesel and a high cetane number
- If used in high concentrations GTL gasoil can be attractive for improving local air quality. –it can be used in old and new vehicles achieving emission reductions immediately without capital investment
- Majority blended into the global gasoil supply chain, diversifying the diesel pool
- It can be used to raise the specifications of heavy fuel products in refineries thanks to technical properties

Cleaner Burning and Smokeless GTL fuels

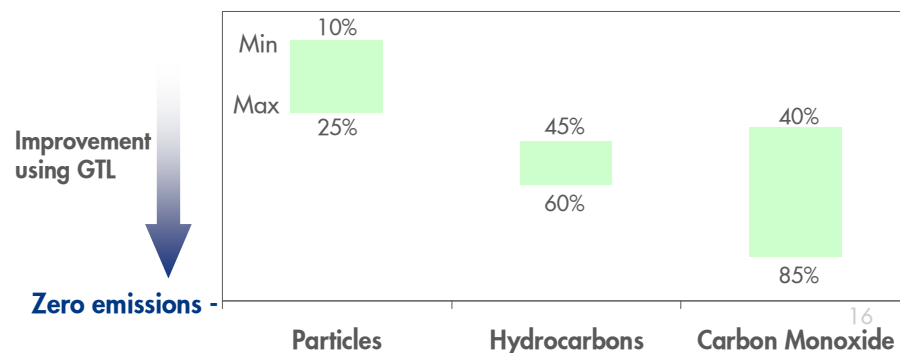


GTL's combustion (on the right) is less sooty

	GTL Fuel	Refinery diesel
Cetane number	75/80	48/56

Cleaner Burning and Smokeless GTL fuels

Emissions improvement range for light duty diesel engines vs refinery diesel



SUMMARY

- There is no single alternative to oil based road transport fuels – all sustainable fuel options will be needed
- Today's biofuels are the most realistic near term commercial solution to take CO₂ out of the transport fuels sector
- Shell is building capacity in biofuels that provide best combinations of performance and low 'well-to-wheel' CO₂ performance from more sustainable feedstocks
- Shell and Cosan have recently announced a proposed JV for the production of Brazilian sugar cane ethanol
- Biofuels growth needs to be supported by the development of advanced biofuels
- Successfully progressing new technologies from lab-based process to demonstration phase and towards commercial scale-up takes time
- In the short term, government policies, incentives and financial support accelerate development from lab to commercial deployment

