



# FUEL *for thought*



## Refinery turnarounds – why do they happen?

The arrival of spring conjures up many images; the first barbecues and drinks on the patio, the return of migrating birds – and Hawaiian-shirted snowbirds – and the annual household spring clean. Another type of spring cleaning can also occur at this time of the year: refinery turnarounds.

Turnarounds are partial or complete shutdowns of refineries aimed at carrying out inspections or replacing and upgrading equipment to ensure safety and reliability and improve environmental performance. As refineries normally operate 24/7, rain or shine, operations need to be scaled down or suspended completely for maintenance. It might seem counterintuitive, but shutdowns actually lead to a significant increase in activity at the refinery. Thousands of workers flock to the facilities to carry out upgrades, which can take from just a few days to several weeks. Large-scale turnarounds, which typically occur every three or four years, are highly complex and can take years of planning – calculating all operations down to the hour to ensure the right people are conducting the right operations at the right time, with the right equipment and in the right order, safely and efficiently. Chevron recently completed the largest and most complex turnaround ever undertaken at its Burnaby BC refinery – detailed planning began in

2013. "We are pleased to report this project was completed safely, reliably and on schedule," said Steve Parker, General Manager of the refinery.

Part of the answer to why turnarounds frequently occur in the spring lies in the changing "recipe" for gasoline and diesel. The formulation for gasoline changes to prevent it from evaporating during the summer, while diesel is modified as properties to prevent it from clouding in cold temperatures are relaxed. This requires a certain overhaul of refinery components and processes, making it an ideal time for maintenance. Spring also coincides with the end of peak heating oil demand and a lower demand for transportation fuels, which minimizes impact on supply. Similarly, turnarounds can also occur in the fall, when refiners switch from summer to winter blends and while demand for transportation and heating fuels is also lower. Refiners ensure a continuing reliable supply of fuels by stocking products in storage terminals – or even barges – ahead of time.

Turnarounds require investments of tens of millions of dollars from Canada's refiners. This, in conjunction with the increased activity that occurs around the clock during refinery turnarounds, provides a significant boost to the local economy, with hundreds or even thousands of workers

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### ***By the numbers*** **Irving Oil refinery** **spring 2014** **turnaround**

- \$60 million investment
- 2000 workers
- 1,000,000 workforce hours
- Total impact of \$51.6 million on New Brunswick's GDP

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needing food, accommodation and other necessities, creating a multiplier effect on GDP. Steps are taken to mitigate impacts of increased activity on communities, such as installing sound barriers and scheduling operations that could affect noise levels during daytime.

As turnarounds involve a large number of contractors and highly complex, non-routine procedures, a commitment to safety is at the forefront of all activities undertaken during refinery shutdowns. All employees and contractors involved in turnarounds undergo extensive safety training and comprehensive emergency plans are in place to ensure the safety of workers and neighbouring communities. Safety specialists conduct daily audits and workers are

encouraged to suspend any operation believed to be potentially unsafe, to signal and discuss and implement corrective measures as required. "With so many people on site conducting potentially hazardous activities, we know we need to be vigilant to maintain an incident and injury-free environment" says Steve Parker.

This proactive approach to safety is the cornerstone of our members' commitment to continuously work to improve the industry's safety record, which is one of the best in Canada's manufacturing sector. While refineries are becoming increasingly complex and productive, total recordable injuries for refining, distribution and retail employees have decreased by 80% in the past 10 years.

## 2015 AJAC EcoRun: putting green automotive all-stars to the test

Today's green vehicles boast impressive fuel economy figures, but how do they stack up in real-world conditions? That's what a group of more than 20 of Canada's finest automotive journalists set about to find out during the 2015 Automobile Journalists Association of Canada (AJAC) EcoRun, which took place March 25 and 26 in the Vancouver area. Twenty vehicles, powered by six different types of powertrains and four types of fuel – electricity, gasoline, diesel and hydrogen – were tested in real driving conditions to provide consumers with accurate information on fuel-efficient vehicles. Fuel economy and air emissions were tracked using Fleetcarma vehicle monitoring systems. The Canadian Fuels Association is proud to support the EcoRun, which helps consumers make informed decisions in personal transportation.

The pure electric Nissan Leaf brought home the top fuel efficiency prize, logging the equivalent of an average of 1.46 L/100 km, trailed closely by another electric vehicle, the Kia Soul EV (1.62 L/100 km), the hybrid Chevrolet Volt (3.81 L/100 km) and the diesel-powered Volkswagen Golf TDI (5.06 L/100 km). Three diesel-powered vehicles were among the top 10 most fuel efficient entrants.

Driving skills were put to the test as well, as driver behaviour has a significant impact on fuel economy. Journalists were on their best driving behaviour as

they faced off to try to achieve the best fuel efficiency numbers in a variety of different cars and light trucks while their driving habits were monitored. Smooth driving is the way to go when trying to save fuel, as rapid acceleration and braking can be a significant drag on fuel economy. In this year's edition of the EcoRun, Green Jersey winner was Chris Chase, of Autofocus.

When it comes to fuel-efficient cars, some powertrains are particularly well adapted to specific driving habits. EVs are well suited for urban dwellers with limited daily mileage, while diesel engines offer convenience and a great performance for consumers who drive long distances. Hybrids provide flexibility, combining the convenience of gasoline with the greater efficiency of an electric engine.

Canada's transportation sector accounts for 24% of the country's greenhouse gas emissions, and personal vehicles make up about half of that amount. Canada's refiners have been working in collaboration with the automotive industry to develop cleaner fuels that will enable the implementation of new clean car technologies; by 2025, cars will be twice as efficient as 2008 models. Cleaner cars and fuels, combined with green driving habits, can lead to a significant improvement of Canada's transportation GHG emissions.



## Cylinder deactivation: delivering power when it's needed

Carmakers worldwide are finding innovative ways to make new vehicles more fuel efficient and comply with new stringent regulations in the U.S. and Canada that will require 2025 model-year cars to be 50% more fuel efficient than their 2008 counterparts. No single technology can deliver those results; achieving that feat will require a variety of advancements, including cleaner fuels, improved engine efficiency and lighter materials. Cylinder deactivation, or variable displacement, is one of the innovations carmakers are using to improve engine efficiency.

Cylinder deactivation is generally used in cars or trucks with six or eight cylinders. When those powerful engines are driven in normal conditions, such as at a constant speed on a level surface, only about 30% of their power is being used, causing the engine to perform less efficiently.

The technology, which is controlled by a car's electronic control system, deactivates half of an engine's cylinders by disabling fuel injectors and intake and exhaust valves when the vehicle's power is underutilized. Engine pistons continue to move, but no fuel is being injected and burned. In addition to saving fuel, it improves airflow to the

engine and pressure in the combustion chamber, which increases overall engine efficiency. When additional power is needed, such as when accelerating, driving uphill or hauling a heavy load, the car's electronics reactivate all cylinders.

Cylinder deactivation typically increases fuel efficiency by 4 to 10%, which can amount to savings of up to \$3,640 and carbon dioxide (CO<sub>2</sub>) reductions of 6440 kg over a 10-year span. The technology delivers the most benefits when a vehicle is driven at a constant speed in conditions that require minimal torque (rotating power of the engine).

While cylinder deactivation sounds pretty high-tech, it's by no means a new technology. General Motors first launched a car equipped with it during the fuel crisis of the 70s, and other companies developed their own versions, but it failed to catch on because of issues with smoothness and reliability. Today's cylinder deactivation systems, backed by modern electronics, are highly sophisticated and deliver fuel economy without the trade-offs.

Sources: [Natural Resources Canada](#), [J.D. Power](#)

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## The changing face of retail

Today's gas stations have evolved significantly since the first gas pumps appeared in Canada over a century ago. With automotive mechanics becoming increasingly complex, gas station repair shops have given way to convenience stores and car washes. But change doesn't stop here; oil companies are constantly re-evaluating their operations to adapt to changing customer needs. In recent years, some companies have chosen to re-think the vertically integrated model, where oil companies are involved in almost every part of

the very complex and diverse supply chain, from the wellhead to the gas pump.

According to numbers from The Kent Group, an increasing number of retail sites are now operated by fuel marketing companies that don't operate refineries, specializing instead in the management of gas stations, convenience stores and ancillary services. That enables oil companies to focus on the complex dynamics of petroleum refining, while companies specialized in fuel retailing and

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marketing operate the gas stations. For instance, the Sobeys grocery chain operates the Shell retail brand in Québec and Atlantic Canada; Valero Energy divested its Ultramar retail operations to CST Brands; and Imperial Oil announced in January that it is evaluating a potential transition of its 500 remaining company-owned gas stations to a branded wholesaler model. Canadian Fuels member Parkland Fuels is a good example of a company taking over fuel retailing, with proprietary brands such as Fas Gas Plus and Race Trac, as well as operating as a retail branded distributor for Esso and Chevron. Parkland operates and serves a network of more than 800 gas stations.

While the brand names of Canada's three major refiners (Shell, Suncor and Esso) appear on 37% of Canada's almost 12,000 gas stations,

more than 80% of retail sites are today controlled by independent businesspeople and non-refining marketers following a variety of business models, up from 70% in 2006. These include regional fuel distributors and "Big Box" marketers such as Canadian Tire and Costco, which have a growing influence on the fuel retail market because of the large volumes they sell despite their relatively small number of sites. Overall, the total number of gas stations in Canada has been going down for more than 20 years, while fuel throughput has been on the rise, and fuel retailing has increasingly been taken over by non-refiner marketers despite the ubiquitous presence of major brands.

For more information, visit [The Kent Group](#)



## Green driving: small changes can deliver big fuel savings

When it comes to personal transportation, refiners and vehicle manufacturers have made huge leaps forward in improving the environmental performance of cars and the fuels that power them. Driver habits are another important piece of the puzzle when it comes to the transportation sector's environmental performance. Below are a few tips to help you save on fuel and improve your vehicle's efficiency:

- 1. Avoid idling:** Unless you are stuck in traffic, turn off your engine when your car is stopped for over a minute.  
→ Fuel economy: 300 millilitres of fuel / 10 minutes of idling
- 2. Check tire pressure:** Underinflated tires wear out faster and reduce vehicle efficiency. Check tire pressure monthly for optimal driving.  
→ Fuel economy: 4%
- 3. Shed the pounds:** In the automotive industry, weight reduction is one of the key ways to reduce fuel consumption. Consumers can do the same by removing any unnecessary objects from their vehicle.  
→ Fuel economy: 1% / 25 kg for a mid-sized car
- 4. Remove unused racks:** Aerodynamics are another key component of fuel efficiency. Roof and bicycle racks create wind resistance and drag; choose models that can easily be removed when not in use.  
→ Fuel economy: As much as 20%
- 5. Go easy on the air conditioning:** Air conditioning relies on a vehicle's air compressor,

which increases fuel consumption. However, driving at highway speed with windows rolled down increases air resistance. When possible, open windows when driving in the city, and use your car's flow-through ventilation system on the highway.

→ Fuel economy: up to 20%

- 6. Drive smart:** Vehicles are least efficient when accelerating or idling. Maximize your vehicle's fuel economy by accelerating gradually and try to keep a consistent speed. Anticipating changing traffic lights and the movements of pedestrians and other motorists can enable you to remove your foot from the gas pedal in advance to avoid braking abruptly or unnecessarily. Respect speed limits – most vehicles perform optimally at speeds varying from 50 to 80 km/h, and driving at 120 km/h burns 20% more fuel than 100 km/h.  
→ Fuel economy: Up to 25% with greener driving habits
- 7. Keep an eye on the fuel consumption display:** Most newer vehicles are equipped with a display that provides real-time feedback on fuel efficiency. By implementing the driving techniques described above and monitoring their impact on fuel consumption, you can achieve significant results.  
→ Fuel economy: Up to 15% by adapting driving habits based on information provided by fuel consumption displays

Adapted from Natural Resources Canada: [Fuel-efficient Driving Techniques](#) and [More Fuel-saving Tips](#)