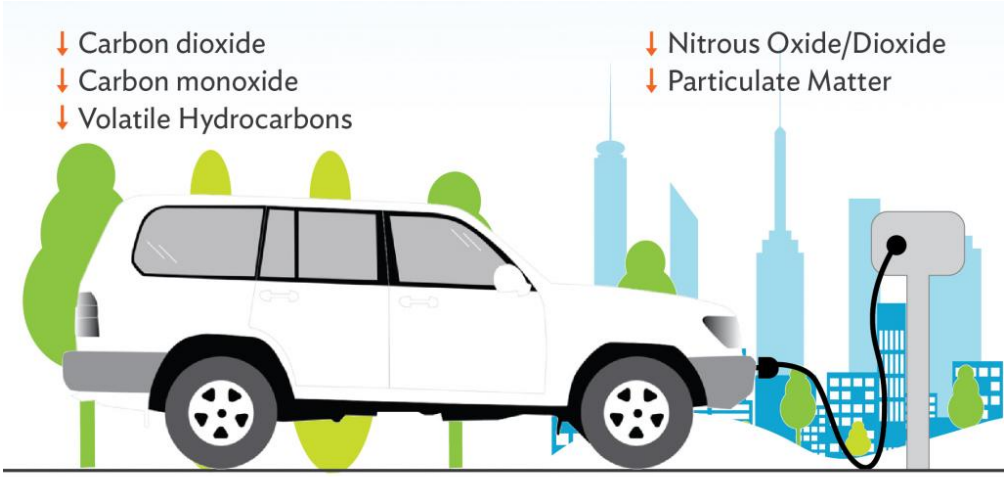
DEVELOPMENT ASIA
An initiative of Asian Development Bank

Finding
Solutions
Together

EXPLAINER

How Block Heater Technology Can Reduce Carbon and Air Pollution



Using a block heater to warm a parked car engine during cold winter months can reduce carbon emissions and other pollutants.

Infographic: ADB.

Idling of motor vehicles during wintertime generates greenhouse gas emissions and other air pollutants, but engine block heaters can lessen the negative impact on the environment.

Published: 28 October 2019

Introduction

Starting a vehicle on a cold winter day can be difficult. It can be hard on the engine, wallet and the environment. It wastes fuel, emits air pollution and greenhouse gases, and puts unnecessary wear and tear on the engine.

When the vehicle engine starts, it circulates oil throughout the engine block to lubricate the moving parts. On winter days when the engine is cold, the oil is very thick, and the engine must work harder to overcome internal friction.

When the temperature outside is below 0°C, the engine can consume about 25 percent more fuel after a “cold start” than when the engine reaches its normal operating temperature. For an average vehicle with

a three-liter engine, every 10 minutes of idling time uses over one-quarter of a liter in wasted fuel.

Apart from fuel wastage, idling time can also generate greenhouse gas emissions that contribute to climate change. Carbon dioxide, the most common greenhouse gas, is an unavoidable by-product of burning gasoline or diesel fuel. The more fuel is used, the greater are the greenhouse gas emissions.

To reduce the impact of starting a vehicle's cold engine during the winter months, engine block heaters are widely used, particularly in northern regions like Canada, Finland, Sweden, Norway and Alaska. The technology has been in use for more than 50 years.

What is a Block Heater?

An engine block heater warms the parked car engine during cold winter months. Like a small electric kettle, it heats the engine using an external electric plug outlet. The optional cabin heater can also warm the vehicle and defrost the windows on cold days. This avoids having to idle the engine. It saves fuel, reduces air pollution, and extends the life of the vehicle.

Block heater technology consists of three main components:

- **Engine block heater.** This is a small electric heating device installed by a trained mechanic or by the automobile manufacturer in the factory. This device warms the coolant, which in turn warms the engine block and lubricants. The engine will start more easily and reach its proper operating temperature faster. Power consumption is less than a small electric kettle or coffee maker.
- **Electric fan heater.** It defrosts the inside of the windows, and provides warmth and comfort to the occupants upon entering the vehicle. Power consumption is about the same as an electric hair dryer.
- **External electric plug outlet.** It supplies power to both the block heater and interior heater.

The Problem with Engine Idling in Winter

On very cold winter days, people often idle the engine to warm the inside of the vehicle before driving. Every liter of gasoline that is burned produces about 2.3 kg of carbon dioxide, a greenhouse gas that causes global warming and climate change. When more fuel is used, more carbon dioxide is produced. One way to cut fuel consumption is to avoid unnecessary idling.

During a 200-day winter season in Nur-Sultan, Kazakhstan, a single typical automobile with a 2.5-liter gasoline engine idling for 60 minutes per day is estimated to consume about 646 liters of fuel.

Fuel combustion is also less efficient in a cold engine because a mixture of more fuel and less air inside the engine is required for efficient combustion. This results in a sharp increase in emissions like particulate matter (soot), as well as large amounts of carbon monoxide, oxides of nitrogen, sulphur dioxide, and volatile organic compounds. These emissions affect breathing air quality especially for people with asthma, senior citizens and young children.

At -20°C, block heaters can improve overall fuel economy by about 10 percent. For a single short trip at -25°C fuel, there could be 25% in savings.

Air Pollution Reduction Impact

The block heater technology will reduce air pollutants and greenhouse gas emissions substantially. Through wide deployment of block-heating technology, Nur-Sultan could achieve a reduction of over 220 million liters of fuel and over 430,000 tonnes of carbon emissions. The table below estimates emissions from around 350,000 vehicles in Nur-Sultan city.

Air Pollutant Emitted	**Hazard and Health Impact**	**Benefit by using Engine Block Heater (net reduction)**
Benefit by using Engine Block Heater (net reduction)	Causes global warming	**?** 433.65 thousand tonnes per year
Carbon Monoxide (CO)	Dangerous gas to humans	**?** 14.5 thousand tonnes per year
Volatile Hydrocarbons (VOC)	Causes difficulty breathing for people with asthma, senior citizens and young children	**?** 2.26 thousand tonnes per year
Nitrous Oxide/Dioxide (NOx)	Causes haze and smog when exposed to sunlight, can also cause acidic rainfall	**?** 1.32 thousand tonnes per year
Particulate Matter (PM 2.5 and Soot)	Causes difficulty breathing for people with asthma, senior citizens and young children	**?** 108.2 tonnes per year

Source: Asian Development Bank estimates

Installing a block heater and cabin heater in cities is similar to installing street lights. The cost will depend on factors like fuel prices, local winter temperatures, and driving habits.

Conclusion

Engine block heater technology is a proven method to save money, improve comfort, reduce pollution and reduce wear and tear on the engine. It also improves air quality, benefitting the residents.

Resources

Government of Canada. Natural Resources Canada. 2008. Block Heaters Save Fuel and Help the Environment. 4 November.

Alberta Motor Association. 2018. Block Heaters 101. 6 April.

Na Won Kim
Senior Urban Development Specialist, South Asia Department, Asian Development Bank

Na Won Kim has 20 years experience in sustainable development, sustainable production and consumption, system innovation, climate change, and environmental policy and governance. She promotes systems-thinking, integrated solutions, collaborative and coherent climate actions in various sectors, preventive approach to enhance resilience and active governance.

Kenzhekhan Abuov
Project officer, Kazakhstan Resident Mission, Central and West Asia Department, Asian Development Bank

Kenzhekhan Abuov works on regional cooperation in Central Asia working with different government agencies and is currently involved in on-going low carbon city development projects in Nur-sultan. Prior to ADB, Ken worked in different ministries of the Government of Kazakhstan. He holds a Master of Public Policy from Korea Development Institute.

Follow Kenzhekhan Abuov on

Ivor da Cunha
Energy Consultant

Ivor da Cunha is an independent energy efficiency consultant based in Canada. He advises utilities, governments, private sector entities and ADB on topics related to energy efficiency and greenhouse gas reduction technologies, programs and policies. He is a chemical engineer by training with relevant experience in Canada, USA, Europe and Asia.

Follow Ivor da Cunha on

Asian Development Bank (ADB)

The Asian Development Bank is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate

extreme poverty. Established in 1966, it is owned by 68 members—49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

Follow Asian Development Bank (ADB) on