

- 2) short journeys;
- 3) lots of stop-start journeys;
- 4) long idling;
- 5) poor quality fuel.

So, if the engine doesn't get worked hard and hot, and then yes it will most likely have more carbon build up. Farm tractors are worst as they are sat idling and often short stop-start journeys at low MPH (miles per hour)/revs.

If your vehicle is suffering reduced MPG and if the cause is carbon build up then yes the engine clean should recover/reclaim that MPG lost due to the systems being dirty.

If any aspect of your cars performance (noise, roughness, idling, hunting, MPG lower, emissions, flat spots, throttle response, sticking EGR (exhaust gas recirculation)/throttle body/swirl flaps) are affected from carbon build up then the carbon cleaning will have a positive effect.

Of course, if any mechanical aspect (swirl flaps for example or EGR valve, turbo) has seized/blocked completely or broken then no amount of carbon cleaning will sort it. Carbon cleaning can't fix things that are fully blocked or broken these would need to be replaced, stripped and cleaned, fixed. However, this cleaning can extend the life of the engine for a long time. It will also help to reduce fuel costs, because after this cleaning, the car consumes less fuel by 5-7%.

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2. How it works – Hydrogen carbon clean [Electronic resource]. – Mode of access: <https://www.engineclean.uk/how-it-works/>. – Date of access: 01.05.2021.

3. Hydrogen purification in agriculture [Electronic resource]. – Mode of access: <https://www.hustlerequipment.com/company/agricultural-innovation/?loc=nz>. – Date of access: 01.05.2021.

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ELECTRIC TRACTORS IN AGRICULTURE

*Students – Dirko N.V., 45 ts, 1st year, TSF;
Yemelyanov V.A., 97 e, 1st year, APF*

*Scientific
supervisor – Misiuk S.V., senior teacher
EI «Belarusian State Agrarian Technical University»,
Minsk, the Republic of Belarus*

Abstract. Electric tractors begin to appear on the world market bringing significant ecological benefits for mankind.

Keywords: electric tractor, driver-optional, smart tractor, automation, machine learning.

Tractor manufacturers are falling off the fossil fuel bandwagon and jumping on the electric train. Every month, another e-tractor announcement comes across our desks. Environmental factors drive this trend, along with energy efficiency, lower maintenance, lower noise level and motor longevity.

Monarch Tractor of Livermore, California, just introduced what the technology manufacturer calls the world's first fully electric, driver-optional, smart tractor integrated onto a single platform.

What makes Monarch Tractor unique is that you are answering the three big challenges farmers have. Farmers have labor shortages around the globe. Farmers are under tremendous pressure from their buyers to reduce emissions and provide more sustainability data (to their buyers). Farmers are also working with razor-thin margins. This tractor addresses those issues by combining electrification, automation, machine learning and data analysis to improve the manager's real-time vision of the farming operation by collecting both visual and digitized data from the field. The Monarch tractor acts essentially as a hub in the field for data collection, observation and even as a local source of remote electrical power. It can be a sprayer, a cultivator, even a drone for recharging other units, while uploading information collected from field operations. The Monarch can create alerts, provide actionable information, as well as give managers close insight into what is going on in a given field [1].

For example, the Monarch incorporates a micro weather station that, among climatic conditions, monitors wind speed. The platform will cease spraying operations if local wind conditions exceed either preplanned or regulatory parameters. When alerted to the stoppage by the Monarch, the remote manager can order it to continue or wait for conditions to change.

The Monarch looks like a compact tractor, narrower than a compact, but slightly longer. Its electric drivetrain can provide 40 horsepower (30 kilowatts) of continuous power and short-duration peak power up to 70 hp (55 KW). The PTO and three-point hitch are comparable to a diesel tractor. It's hydraulic capacity equals or exceeds conventionally powered units of the same size. Because it is electric, the Monarch has two times as much torque as comparable units.

The Monarch is powered by a large battery with 10 hours or more of operating time. Under high workloads, the battery is designed to give owners four to five hours of operation. The battery system lasts 10 years. A battery recharge requires up to five hours. However, Monarch sells as an option a swappable battery pack. The swap can be completed by one person in 10 minutes. The location of the battery, over the front axle, is a design feature to give the tractor improved stability. More weight on the axle means less ballast is needed on the front [1].

Monarch owners own the sensor and visual data collected from their units. The Monarch tractor is 100% electric and has zero tailpipe emissions. It serves as a kind of three-in-one tool, operating not only as a tractor, but with extra storage, it acts as an ATV, and it has the capabilities to be a powerful generator in the field. The tractor can perform preprogrammed tasks without a driver, or an operator can use Monarch's interactive automation features, including Gesture and Shadow modes, to have the tractor follow a worker on the job. The Monarch tractor features roll-and collision-prevention capabilities, vision-based PTO safety and 360-degree cameras to keep operations running smoothly and employees safe, day or night. The Monarch tractor collects and analyzes over 240 gigabytes of crop data every day it operates. It can work with farmers' current implements as well as the next generation of smart implements. Sensors and imaging are processed to provide critical data points that can be used for real-time implement adjustments, as well as long-term yield estimates, current growth stages and other plant/crop health metrics. Utilizing machine learning, the Monarch can digest this data and provide long-term analysis of field health, improving accuracy the longer it runs. By way of a smartphone or personal device, users receive tractor alerts, updates on current micro weather conditions, detailed operations reports, data collection and analysis [2].

This tractor is just one bright example of electric tractors on modern market. Other companies such as John Deere and Kubota also produce electric tractors, helping us create a more sustainable future with zero carbon emissions and better energy efficiency.

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STANDBY ELECTRIC POWER SYSTEMS FOR AGRICULTURE

*Students – Hrushyn V. S., 1st year, APF;
Nester R.D., 22 mo, 4th year, TSF*

Scientific

*supervisor– Bernatskaya D.A., teacher
EI «Belarusian State Agrarian Technical University»,
Minsk, the Republic of Belarus*

Abstract. This article discusses the importance of backup power supply systems, as well as their need for the operation of agricultural equipment and facilities.