



**Green Nanoparticles** for Carbon-Neutral Oil Production

Our well sites are going to  
*net zero*

## Green Nanoparticles for Oil Production Enhancement.

Getting to  
**NET-ZERO  
EMISSIONS** by 2050

- ~\$9.00 per barrel all-in incremental production cost.
- Payback is about 1 to 3 months.
- Achieves ESG standards that safeguard the environment.
- Canadian operators' costly per barrel carbon tax is eliminated.
- Generates carbon credit revenue from emissions offset buyers.
- Low-cost nanofluid injection treatment at ambient temperature.
- Equipment includes only green nanofluid, pump, valves, and flexible steel hose.
- Nanofluid is injected at ambient temperature and creates a chemical reaction that generates significant high-temperature heat reduces the viscosity up to 99% of heavy oil.
- Generates significant BTUs of energy that creates increased reservoir pressure.
- First-of-its-kind nanotechnology for shale oil, light oil, heavy oil, and oil sands.
- NaNoEOR aims to inspire oil companies to license the green nanotechnology to extract hydrocarbons in a carbon-neutral approach to help reach net-zero emissions by 2050.
- NaNoEOR's long-term vision is to keep stripper wells producing at economic production rates in an environmentally safe manner and maximizing the recovery.

- ✓ **Zero-emission green nanoparticles for carbon-neutral oil production.**
- ✓ ~\$9.00/bbl incremental production achieves a payback in about 1 to 3 months.
- ✓ Delivers **green nanofluid** to at 6,000+ ft.
- ✓ Zero-emission alternative to an OTSG for heavy oil and oil sands production.
- ✓ Achieves a low steam-oil ratio (SOR) that reduces production cost.
- ✓ Cost of new wells is avoided.
- ✓ Generates high-temperature heat reduces heavy oil viscosity 99% (~400,000 cP ultra-heavy oil reduced to 259 cP).
- ✓ Zero-emission carbon-neutral oil production achieves ESG standards that safeguard the environment.
- ✓ More oil recovery at a faster rate increases profit.
- ✓ Minimal maintenance helps reduce costly downtime.
- ✓ Canadian operators carbon tax is avoided.
- ✓ Production enhancement of light oil, heavy oil, oil sands and shale oil.
- ✓ Replaces costly toxic chemical surfactants and/or solvents.
- ✓ New reservoir pressure enhances stripper well production.
- ✓ Nanofluid is injected at ambient temperature.
- ✓ Viable alternative to heavy oil steam injection instead of an OTSG steam generator achieving a low steam-oil ratio.

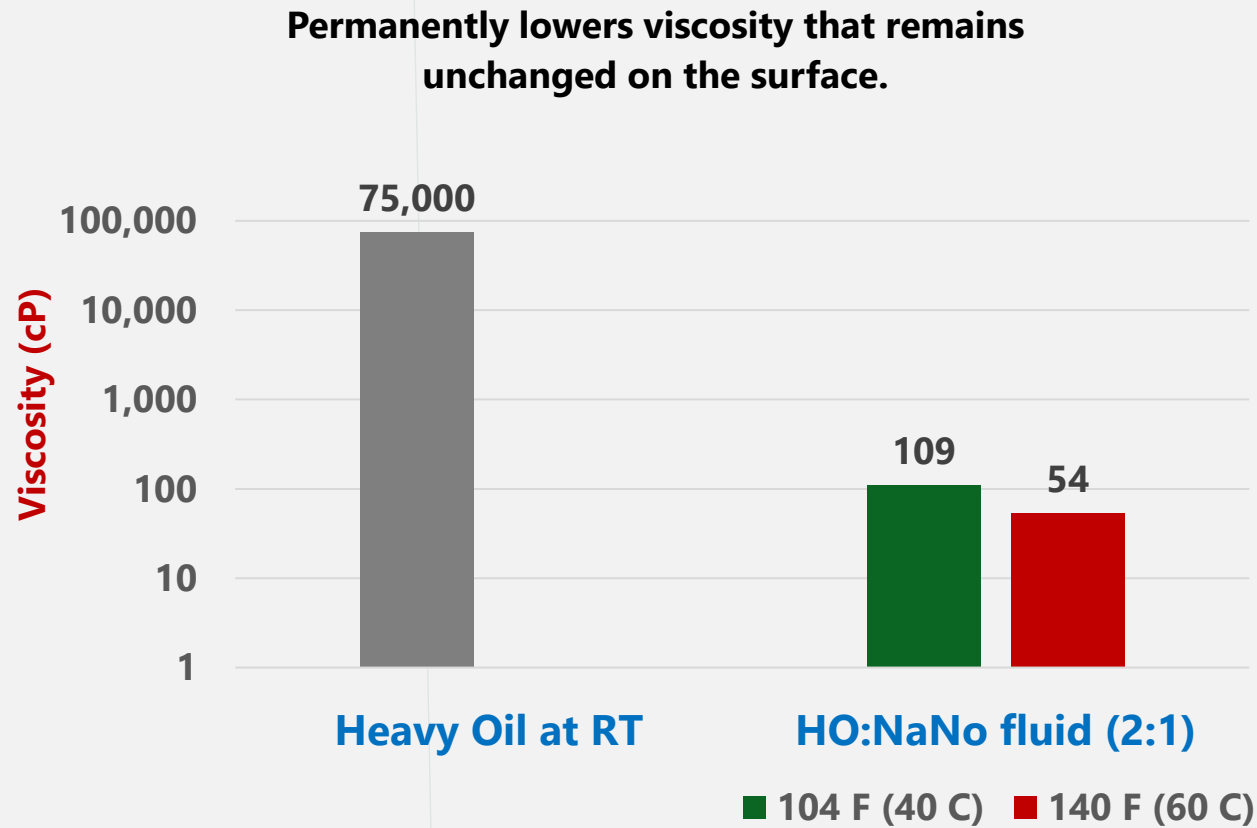
**NaNoEOR** is a transformational nanotechnology that is in a "class by itself" and therefore "unique and innovative".

## NaNoEOR Product Overview

- The goal of **NaNoEOR** is to significantly improve oil recovery that eliminates greenhouse gas emissions to achieve carbon-neutral oil production.
- **Green nanotechnology** is a transformative in-situ EOR technique.
- **Green nanofluid** is injected at ambient temperature.
- Extremely low-capital investment that just requires a novel non-toxic, 100% biodegradable **green nanofluid**, pump, hose, and valves.
- Permanently lowers viscosity remains unchanged on the surface.
- Game-changing **green EOR nanotechnology** will solve oil recovery problems.



## 99% viscosity reduction for heavy oil and oil sands



# VALUE PROPOSITION

**NaNoEOR green nanotechnology is a very profitable oil extraction technology.**

- ✓ **Green nanoparticles for carbon-neutral oil production.**
- ✓ Injection treatment cost ~\$9.00/bbl incremental production.
- ✓ Reduces heavy oil viscosity 99.99% that remains unchanged at surface.
- ✓ Nanofluid is delivered to at least 6,000+ft reservoirs.
- ✓ Low CapEx and OpEx reduces production cost per barrel of oil.
- ✓ Canadian operators costly carbon tax is avoided.
- ✓ Low steam-oil ratio compared to conventional steam injection.
- ✓ Generates carbon credit revenue from emission-offset buyers.
- ✓ Off-the-shelf system – no equipment manufacturing.
- ✓ Achieves ESG standards to safeguard the environment.
- ✓ Simple green EOR solution.

**NaNoEOR is a simple, low-cost and transformative green EOR nanotechnology.**

## More Oil Production + Lower Costs = Higher Profit Margins

- ✓ NaNoEOR achieves 99% viscosity reduction of heavy oil and oil sands.
- ✓ NaNoEOR avoids Canada's carbon tax for each barrel of oil produced.
- ✓ Best-in-class green nanotechnology oil extraction technology.
- ✓ **Mission Statement:** Seamlessly integrate green nanotechnology to provide cost-effective, carbon-neutral oil extraction solution.
- ✓ **Company's Motto:** Achieve the low-cost carbon-neutral oil production.
- ✓ **Long-Term Vision** is to help the oil industry transition to a decarbonized, net-zero business by 2050.
- ✓ **Long-Term Vision** is to keep stripper wells producing at economic production rates in an environmentally safe manner and maximizing the recovery.



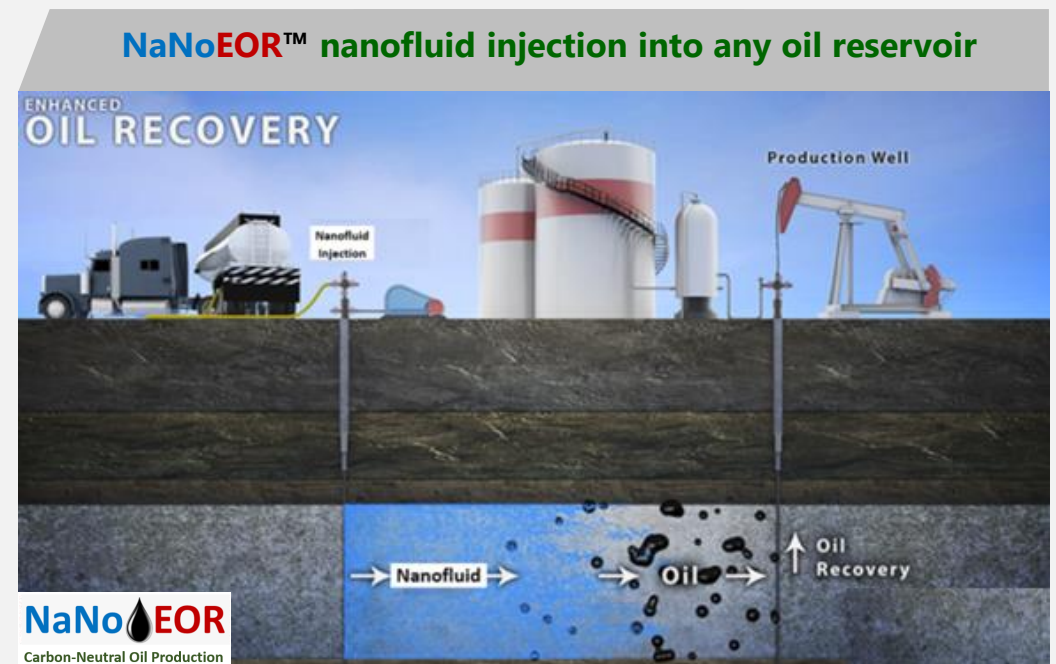
- ~\$9.00/bbl. all-in incremental production cost
- Payback in 1 to 3 months
- Non-toxic and 100% biodegradable
- 99% viscosity reduction (>75,000 cP)
- Remediates paraffin / asphaltene in well & perms
- Improves flow assurance near wellbore region
- Increases pressure enhancing production
- Increases proved reserves and asset value
- Extends longevity of declining wells
- Refractures steep decline shale oil & gas wells
- Prevents premature plugging
- New paradigm = NaNoEOR-Surfactant-Polymer
- Benefits shale oil, light oil, heavy oil and oilsands
- Sustainable oil production achieves ESG goals

## **LAB TEST RESULTS**

- Heavy oil viscosity reduction remains unchanged
- Wettability alteration improved oil's mobility
- Interfacial tension reduced up to 82%
- Rheology altered for better oil flow
- Permeability significantly increased
- Achieved higher sweep efficiency
- Created oil-water emulsion stabilizer
- Improved capillary pressure increased oil recovery
- Nanofluid injected at ambient temperature
- ~36% increased recovery of OOIP
- Asphaltene precipitation prevented or delayed
- ~42% heavy oil sulfur reduction

## Revolutionary and Transformative Nanofluid

**Game-changing green nanomaterials** generates significant BTUs that reduces heavy oil viscosity 99%, increases permeability, creates increased reservoir pressure, decreases interfacial tension, causes wettability alteration and improves sweep efficiency for increased oil production.



# PROCESS OVERVIEW

- ✓ **NaNoEOR** is a low-cost green nanotechnology system delivering a complete functional production enhancement solution in hydrocarbon reservoirs.
- ✓ **NaNoEOR** has minimal maintenance that reduces costly downtime.

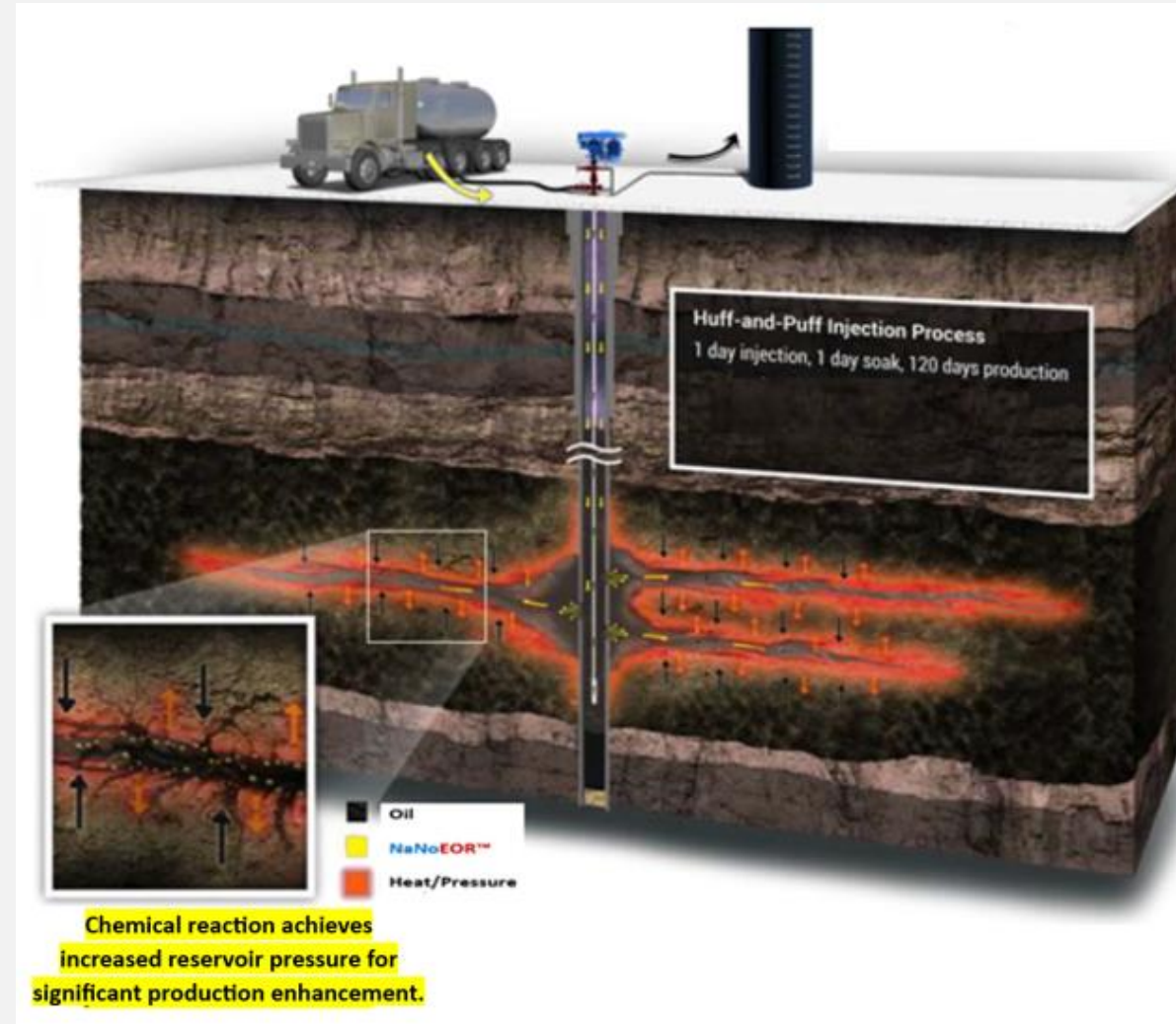
## How **NaNoEOR** Green Nanotechnology Works

- Low-cost green nanofluid is non-toxic, non-corrosive, and 100% biodegradable nanoparticles;
- Green nanofluid is injected at ambient temperature into the reservoir creates a chemical reaction that generates significant BTUs, substantial heat to reduce heavy oil and oil sands viscosity 99% and increased reservoir pressure;
- High-temperature heat creates increased reservoir pressure, increases permeability for improved sweep efficiency, reduces heavy oil viscosity 99%, alters wettability and reduces interfacial tension.

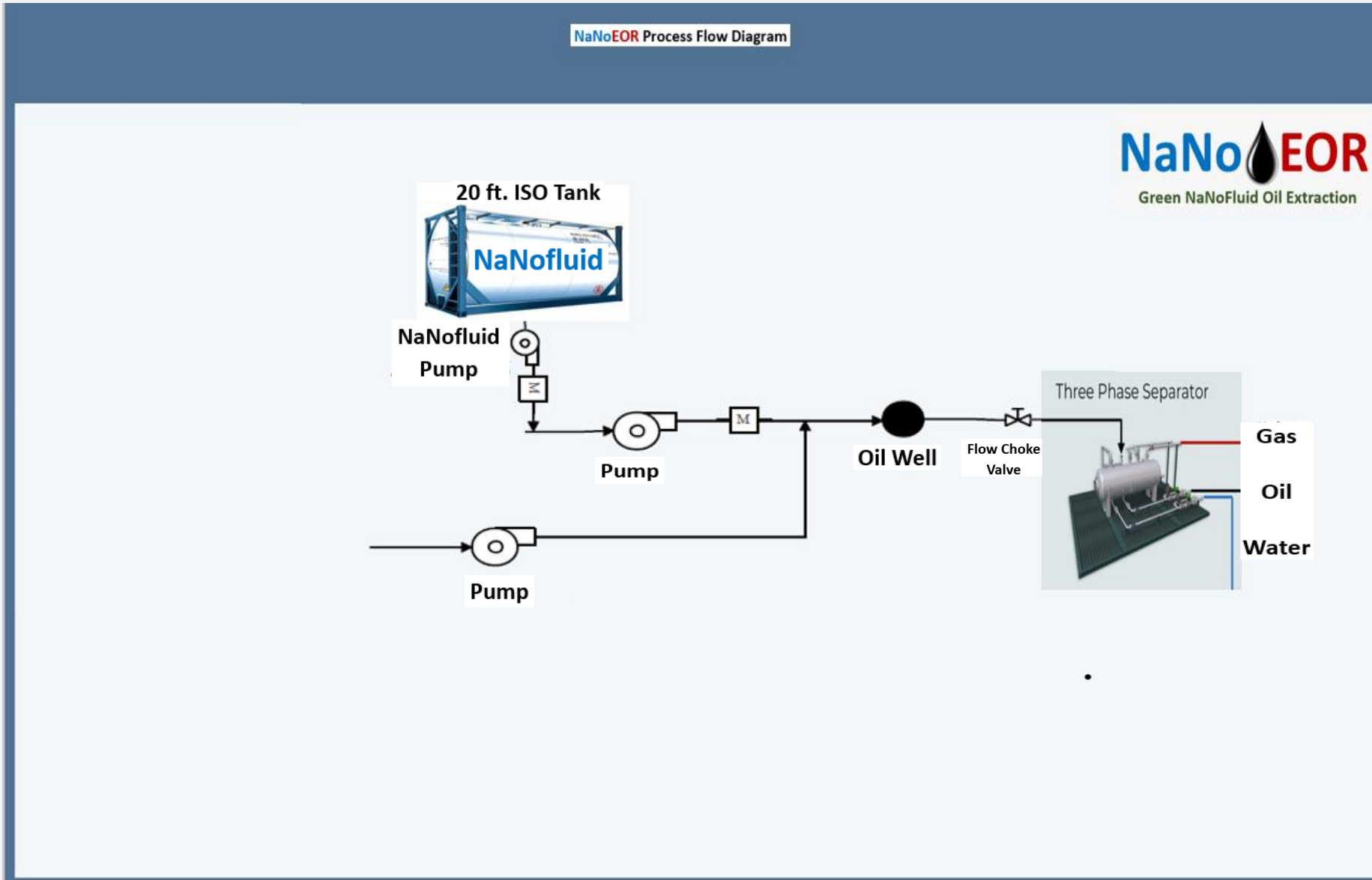
**Carbon-neutral oil production future is here now.**

**NaNoEOR** is a transformational production enhancement nanotechnology that is in a "class by itself" and therefore "unique and innovative".

➔ **NaNoEOR** process flow diagram is on the following page.



# PROCESS FLOW DIAGRAM





The oil and gas industry has always been at the forefront of technological innovation, and the latest development in nanomaterials for enhanced oil recovery (EOR) is no exception. As the world's demand for energy continues to grow, the need for more efficient and environmentally friendly methods of extracting oil becomes increasingly important. Nanomaterials, which are materials with dimensions on the order of a billionth of a meter, have shown great promise in the lab for improving EOR processes. Now, these innovations are making their way from the lab to the field, offering the potential for significant improvements in oil recovery rates and reduced environmental impact.

One of the primary challenges in oil extraction is that a significant portion of the oil remains trapped in the reservoir after conventional recovery methods have been employed. This is due to a variety of factors, including the viscosity of the oil, the presence of water, and the complex structure of the reservoir rock. EOR techniques, such as injecting chemicals, gas, or steam into the reservoir, have been developed to help mobilize this trapped oil and improve recovery rates. However, these methods can be expensive, energy-intensive, and potentially harmful to the environment.

Nanomaterials offer a promising alternative to traditional EOR methods. Due to their small size and unique properties, nanomaterials can interact with oil and reservoir rock at the molecular level, enabling them to overcome some of the challenges associated with conventional EOR techniques. For example, nanoparticles can be used to alter the viscosity of oil, making it easier to flow through the reservoir and be extracted. They can also be used to improve the effectiveness of chemical EOR methods by acting as catalysts or carriers for chemical agents.

One of the most promising applications of nanomaterials in EOR is the use of nanofluids, which are suspensions of nanoparticles in a base fluid, such as water or oil. These nanofluids can be injected into the reservoir to improve oil recovery by altering the properties of the oil and the rock. For example, nanofluids can be used to reduce the interfacial tension between oil and water, making it easier for the oil to flow through the reservoir. They can also be used to modify the wettability of the rock, which can help to mobilize trapped oil.

Several pilot projects have been conducted to test the effectiveness of nanomaterials for EOR in the field. In one such project, a nanofluid containing silica nanoparticles was injected into an oil reservoir in China, resulting in a significant increase in oil production. In another project, a nanofluid containing carbon nanotubes was used to improve oil recovery in a heavy oil reservoir in Canada. These successful field trials demonstrate the potential of nanomaterials for EOR and have generated significant interest from the oil and gas industry.

Despite the promising results from these pilot projects, there are still several challenges that must be overcome before nanomaterials can be widely adopted for EOR. One of the main challenges is the cost of producing nanoparticles, which can be high due to the complex manufacturing processes involved. Additionally, there are concerns about the potential environmental impact of using nanomaterials in oil recovery, as their small size and unique properties may pose risks to the environment and human health.

To address these challenges, researchers are working to develop more cost-effective methods for producing nanoparticles and to better understand the potential environmental risks associated with their use. As these issues are resolved, it is likely that the use of nanomaterials for EOR will continue to grow, offering the potential for significant improvements in oil recovery rates and reduced environmental impact. With the global demand for energy showing no signs of slowing down, the successful transition of nanomaterials from the lab to the field could play a crucial role in meeting the world's energy needs in a more sustainable and efficient manner.

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# ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG)

What sets **NaNoEOR** apart is our novel **green nanotechnology** that will help oil companies reduce emissions and achieve carbon-neutral oil production to accelerate decarbonization and net-zero emissions by 2050.

**NaNoEOR's green nanotechnology** will help oil companies diversify into carbon-neutral oil production and generate carbon credit revenue to achieve higher net revenue.

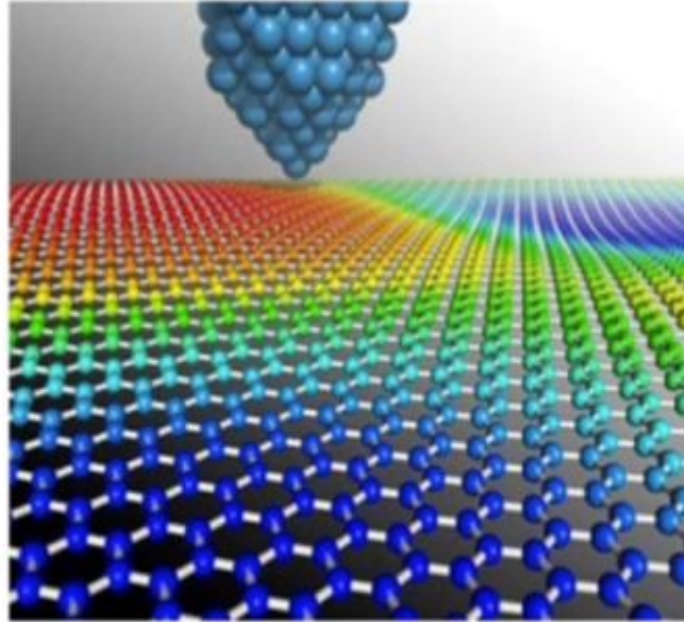
**NaNoEOR** will help Canadian operators avoid the costly per barrel carbon tax and offset their greenhouse gas emissions.

**NaNoEOR** is building a purpose driven nanotechnology license business that can help operators successfully implement our **green nanotechnology** to enhance their objectives to help them achieve Environmental, Social and Governance (ESG) standards that safeguard the environment.

**NaNoEOR** desires to help the community's citizens health and well-being to provide the societal benefits to the environment by improving air quality, reducing water consumption, and maintaining high paying jobs improving the local economy.



Enhanced oil recovery from  
the perspective of a disruptive  
green nanotechnology.



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Net-Zero Emission  
**2050**