Energetic Mist for
Gasoline, Diesel & Bioethanol

Wubin Building
Yangjae-dong, Seocho-gu
Seoul, South Korea
+82 10 2178 5210
samuel.jun@tuireann.energy
https://www.tuireann.energy

Introduction

The internal combustion (IC) engine is facing challenges due to heavy dependence on limited reserves of fossil fuels and requirements for improving emissions levels. These are forcing new solutions to be explored such as cleaner engines, fuel additives and emission reducing solutions, along with renewable energy generators and electric vehicles. However, no one solution has successfully addressed both reliance on fossil fuels and emissions levels.

Challenges: Governments all over the world are pressing hard for stringent environmental regulations to reduce emissions and protect air quality. These are impacting engine manufacturers by enforcing them to provide more clean and efficient engines. In Europe, by 2021 all new passenger cars must produce at maximum 95g/km of CO_2 compared to the current average of 132g/km. By 2020, the EC has also set the goals of reducing emissions by 20% compared to 1990 levels and increasing energy efficiency by 20%. By 2030, these goals are 40% and 32.5% respectively. More stringent regulations over NOx are made as well. For example, the International Maritime Organisation is introducing new NOx Emission Controls aiming to reduce NOx emissions by approximately 70% compared with the previous standards. Engine manufacturers are concerned about increasing the efficiency of their engines to remain competitive and are looking for ways to comply with ever stringent legislation. Engine users are concerned about the cost of fuel but also require cleaner engines which pass their national vehicle tests, reduce their road tax burden and allow them to enter all drivable areas.

Efficiency or emissions: Regulations and environmental directives are challenging IC engines to reduce emissions such as CO, NOx and soot. Greater IC efficiency reduces CO_2 emissions, which is why diesel engines have been preferred for last two decades. However, it has been found that diesel engines have a serious problem of NOx as well as known soot emissions.

Improvement costs: In order to fulfil worldwide emissions and efficiency targets engine manufacturers are facing huge development costs. They can face hefty fines if their engines do not meet emissions standards. And yet, despite these huge investments, modern diesel cars show continuous technical problems with exhaust gas recycling devices, particulate filters and selective catalytic reduction devices to reduce emissions. While gasoline engine efficiency levels have stagnated and only incremental improvements have been achieved. These high development costs are then reflected in a higher vehicle cost for the consumer.

Poor additive solutions: Fuel additives are an alternative way to optimise engine performances and emissions to meet regulations and environmental directives. However, no fuel additives on the market have been verified up until now, to reduce fuel consumption and emissions at the same time. Recently, nanofuels, that contain metal nanoparticles, have shown the potential to reduce emissions and improve efficiency. But, because a large quantity of metal nanoparticles are needed to have an obvious impact, they can lead to metal related engine damage and environmental hazards. This restricts them from becoming a widespread solution.

Current advances in water and nano technologies gave birth to highly cost efficient and safe energy harvesting nanofluid solutions to meet emission targets which, other existing technologies cannot offer. Nanofluid is an emerging field of nano technology, and the application of the energy harvesting nanofluid into conventional fuel is an innovative concept, yet its fullest potential was unrevealed. Tuireann Energy is a frontier, leading a new type of nanofluid incorporating only ppm level of metal nanoparticles, while the effect is more outstanding than heavy dosage of energetic metal nanoparticles.

The first prototype ***T1 Formula*** is applicable to the worldwide cars, generators, ships and energy markets. In contrast to other fuel additives, T1 shows a remarkable emission reductions without incorporating any combustible ingredients. The uniqueness of T1 Formula is that it works both for spark and compression ignition engines with a special injection method of providing through the air. Today's estimation is that ***only 0.1 ~ 10ml of T1 solution is needs to be added per litre of fuel***.

The minimised incorporation of metal oxide nanoparticles in the fuel additive attracts ***two major advantages*** in comparison with the existing nanoparticle fuel additive technologies. First of all, T1 is benign to the engine, thus there is ***no potential influence on the engine life cycle.*** Secondly, ***the potential health risks due to the nanoparticles are negligible***, since less than 0.01 ppm of metal nanoparticles in the fuel is involved in the combustion.

T1: A Clever Combination of Nanofuel and Air Humidification

T1 Formula is an aqueous alkaline solution containing less than 10 mg/L or ppm of dispersed metal nanoparticles.

Nanofuel: Metal nanoparticle additives or nanofuel such as aluminium have been used in solid form for rockets for many years as a way of increasing the performance, since they have the ability to increase the volumetric heat release of the propellants. Fine particles and microparticles of aluminium, as well as boron and zinc, have also been numerously investigated as a potential fuel additive. Cerium oxide is known to behave as an oxygen-storing agent in the diesel exhaust catalyser. Advances in fabrication and characterization of nanoparticles have allowed more detailed research into the relationship of particle size and structure with performance. Recently, the introduction of nanotechnology has led to significant developments in the field of energetic materials. Nanoscale energetic materials, due to their surface area and unique thermal properties, are known to exhibit many advantages, where the oil and automobile industries can adopt to solve practical problems.

Some study of nanofuel additive with diesel combustion engines reports CO and NOx have been reduced up to 20.5 and 13 %, respectively, and HC reduced by 28 %. The same study also indicates a 3 % fuel consumption reduction accompanied with 6 % improvement in the engine power. Another study reports 70% reduction in HC emission and 41 % reduction in CO emission for biodiesel with nanoenergetic fuel additive. It is evident from all the studies that the diesel engine performance improves appreciably with nanofuel additives for all the cases of diesel, biodiesel and emulsified fuels.

Debate about the nanoparticle hazards: The metal in the fuel additive can be accumulated in the combustion system, which may be harmful to the system. The environmental safety of the metal nanoparticles is in question at this time. There is therefore a need for fuel additives that can actively assist in the combustion cycle yet are not contributing adversely to environmental effects. Consequently, a minimum dosage of metal nanoparticles is preferable, hence the overall toxicity of the emissions will be negligible in the presence of the exhaustion particulate filter system. There are hardly a nanofuel additives developed to date can 'go to market' due to the high level of metal nanoparticles that may cause engine damage and health risks.

Air humidification method: Water injection or a mixture of water and ethanol/methanol injection, or air humidification method as a more advanced technique, has been attempted to improve the engine performances. Gasoline engines mainly show an improved octane number with this technology, with the result that there is an improved anti-knocking and a power enhancement effect achieved. Diesel engines mainly show a reduction of the combustion temperature with this technology, and this assists in a reduction of NOx exhaustion.

Side effect of water in combustion: Water injection / air humidification techniques are cutting edge techniques nowadays, however, at the same time it is also known that water injection is generally known to enhance CO exhaustion and may reduce the fuel efficiency unless it is optimised accurately. The water aerosol size is a critical factor in this technology, since water aerosols of a big size can hinder the uniform air-fuel mixture in the combustion chamber.

T1 is the world's first nanofluid additive to substitute water injection / air humidification techniques.

By adding nanoparticles to the water and reducing the injection amount, T1 reduces fuel consumption, CO, NOx and soot together. Unlike other fuel additives, it works better if it is provided through the air intake with a controlled size of mist. It also is benign to the engine and potential health risks are negligible.

T1 Formula takes the advantage of water injection to reduce the combustion temperature and NOx, but compensates the disadvantage of fuel consumption, CO and soot increase by introducing only a minor quantity of metal nanoparticles. This allows T1 Formula to take only the advantages of water injection / air humidification, while suppressing the need for large-scale use of nanoparticles for engine and environmental safety.

Low Concentration Aqueous Nanofluid Fuel Additive - Solution to both Safety and Performance

It is believed that the metal oxides in combination with the blended carrier scavenge water from the fuel system, utilising the oxygen component to increase combustion efficiency. Metal oxide based additives have been reported to be effective in reducing diesel emissions in two ways: 1) the metal oxides react with water vapour in the exhaust emissions to produce highly reactive hydroxyl radicals, and 2) the metals serve as an oxidation catalyst and thereby lower the oxidation temperature for diesel soot and lead to increased particle burn out.

Studies have shown that the addition of nanoparticles to water may substantially improve the thermal conductivity and mass transfer inside the fluid, even at low concentrations. This enhancement effect is dependent on temperature, and thus provides enhanced thermal transport and heat sink capabilities for fuels as well. Water can react with metal nanoparticles during combustion to generate hydrogen, and hence, increase the nanofluid combustion heat. Hydrogen burns in a diesel engine in the presence of an active aqueous nanofluid. The metal oxide nanoparticles present in a fuel additive can have high catalytic activity because of their large contact surface area per unit volume and can react with water at high temperature to generate hydrogen and improve fuel combustion.

A study indicated that the micro-explosion phenomenon of the fine sized water droplets in the combustion chamber can accelerate fuel evaporation, and its mixing process with air, thus reducing the overall combustion duration.

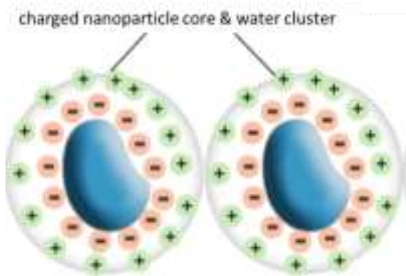
T1 Formula is added to fuel with a ratio of 1000:1. Total metal oxide nanoparticles from T1 in the mixed fuel would be less than 0.01ppm.This means that the vehicle safety and the environmental issue due to metal nanoparticle would not be the case for T1.

Selecting optimal range of nanoparticle addition as well as the base fluid preparation is the key to the miraculous performance of T1.

Principle of T1 Formula

How is it possible to alter the fuel performance with such a little dosage of nanoparticles?

T1 is inspired by lightning phenomenon. It is about the catalytic effect of static electricity. A single bolt of lightning contains 5 billion joules of energy, enough to power a household for a month. On the earth 14 billion times of lightning flash in a year. The energy of a thunderstorm equals that of an atom bomb. We believe that a certain condition with metal nanoparticles can charge water droplets, which can show catalytic effect of fuel combustion.



We found a clue that a certain condition with metal nanoparticles can charge water droplets, creating "nanoparticle - water" cluster, which can show catalytic effect of fuel combustion. In this case, an electrical double-layer forms when a particle is placed in the dispersing medium. The interior layer is the surface charge of the nanoparticle, and the outer layer is the diffuse layer of water envelop. The nanoparticle work as the seed of the cluster, therefore we need only a minor quantity.

Due to the coulomb repulsion, the charged cluster does not agglomerate and stay as fine mist form and mixes with air uniformly in the combustion chamber. The electrostatic binding within the cluster prevents water from entrapping the fuel.

As the temperature and pressure of the combustion chamber increases, explosive breaking of the cluster prior to the main explosion will spread the ionised water and metal oxide nanoparticles in the chamber uniformly. ***This explosive migration and collision will enhance the uniformity of air-fuel mixture in the chamber.*** In this process, the heat is absorbed by the water or the cluster for evaporation. Therefore ***the combustion temperature would be lower***, while the mechanical movement in the combustion is enhanced. Through this effect, ***NOx can be reduced***.

Further, the alkaline ions in T1 remove particle precursors. The ions inhibit the nucleation of particle precursors showing detergent effect.

Value Proposition

Our customers are both manufacturers of IC engines and end users such as vehicle owners, logistics companies, ship owners, generator operators and large users of fuels. Engine operators will be able to use T1 Formula by purchasing an engine with T1 Injector preinstalled by the engine manufacturer, but they will also be able to install T1 Injector onto their in-use engine. Typically T1 offers average fuel savings of 10% for gasoline and 8% for diesel.

Case1: A driver changing a diesel into a gasoline car, he/she will pay 33% more for fuel because of the different fuel price and the lower efficiency. However T1 can reduce the fuel cost by average €200/year (= €250 fuel save - €50 T1 cost) per passenger car.

Case2: An old medium size diesel truck owner could pay at least €10k to retrofit diesel exhaustion treatment devices to satisfy the new regulation. In addition, the owner should pay €100/month for Adblue. The fuel consumption goes up by 3% (≈€100/month) because of the exhaustion modification. If they use T1 system instead, retrofit is €100 (over 100 times less cost) and the owner will save €340/moth (= 8% fuel save by T1 + €100 Adblue cost save + €100 prevention of extra fuel efficiency decrease - €100 T1 cost).

Case 3: A luxury car maker pays €2M/year extra taxes because of the high emissions of the 12 cylinder engine. If they can show that the emission satisfies Euro 6 by adopting T1 technology, they will save €2M/year tax on top of a better image for the company.

Globally, there are 1.4b cars, trucks and buses in use, and this is expected to rise to 2.8b by 2036. In the UK and Ireland there are 31.6m and 2.7m cars, and 1m and 500k trucks respectively. There are over 53,000 commercial freight ships globally. And, around 1m generators are produced annually.

Unique selling proposition: T1 is the world’s first water-based nanofluid fuel additive that significantly improves efficiency and reduces emissions at an affordable price. T1 is a game changer for the IC engine market offering an alternative to meet expected demand and increasingly stringent regulations.

Comparison of T1 with the claims of other existing fuel saving additives

	T1	Product E	Product X	Product D
Fuel saving "up to"	15%	11%	8%	10%
Fuel saving "average"	8% for diesel 10% for gasoline	5%	7%	None
Independent Lab test	Kia Soul and Hyundai Sonata	None	None	None
Mixture ratio (additive/fuel)	0.01 - 1%	0.025%	0.01%	0.5%
Composition	Over 99.99% Alkaline water + under 10ppm nanoparticle	Solvent + Metal Nanoparticles over 20,000ppm	Solvent + Enzyme	Ingredient undisclosed
Mixing method	Optimised injected through the air intake	Direct mixture into the fuel	Direct mixture into the fuel	Direct mixture into the fuel
Patent	Filed	Yes	Expired	None
Academic Research	Yes	Yes	Rare	None

Chances with T1 Addition into Bioethanol Mixed Fuel

All gasoline sold in the EU typically contains up to 5% ethanol. A new EU target of 20% ethanol mixture would challenge vehicle manufacturers to optimise the combustion process in the engine, imposing lower fuel consumption, reduction of CO2 emissions and other pollutants even further.

By mixing ethanol into fossil fuel, with its high oxygen content, CO emissions can be reduced. Higher ethanol blends also produce lower levels of polluting NOx emissions. NOx is produced when fuels burn at high temperature. Higher blends of ethanol can reduce NOx emissions because of ethanol's cooling effect on engine temperature. By increasing the ethanol content of the fuel tank, HC and particulate matter emissions can be reduced.

However ethanol is hydrophilic, water is attracted into the fuel tank. In ideal conditions, E10 (10% ethanol & 90% gasoline) will keep roughly 0.5% water by volume. Water does not burn well in the engine leading to premature engine & fuel system corrosion and poor engine performance. In addition, heat of evaporation of ethanol is about 3 times higher than that of gasoline, cold start would be difficult.

Nanomaterial and the altered surface tension of water in T1 Formula may substantially improve the thermal conductivity and mass transfer inside the liquid even at low concentrations. An existing study validates our claiming by showing the burning characteristics of ethanol droplets containing nano- and micron-sized aluminium particles as a catalyser, the fuel burnt completely. The poor ignition characteristics of ethanol in cold weather conditions, and low flame temperatures are mitigated by the nanoparticles.

Therefore ***T1 Formula would be a good candidate to overcome the temperature related ignition problem and water related performance problem*** of ethanol-fuel mixture.

Fuel Additive Evaluation by Ricardo Lab. University of Brighton

Date

23rd ~ 26th Sep 2019

Tested Engine

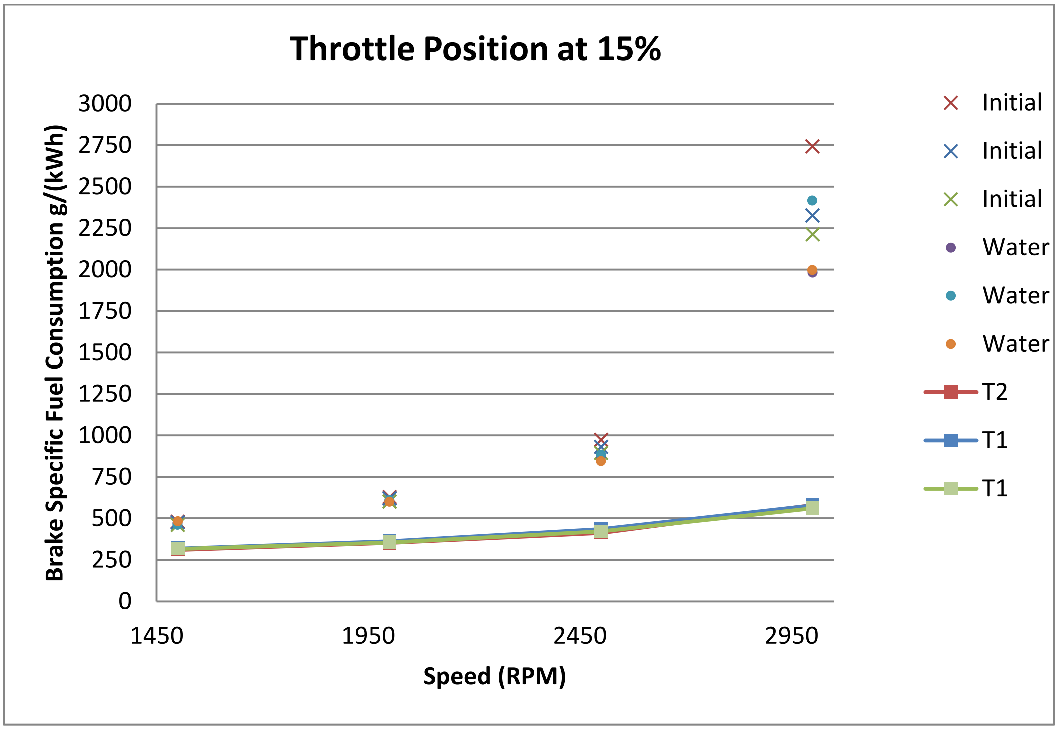
Skoda Fabia Gasoline 1.2 L

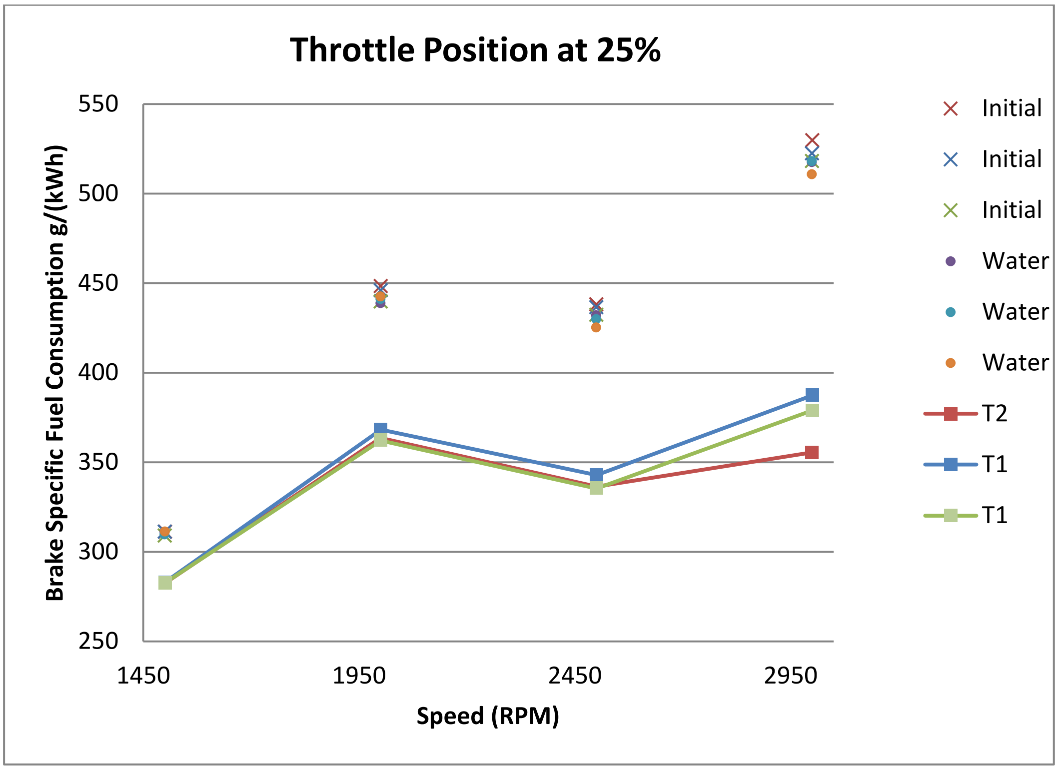
Dyno Analysis System

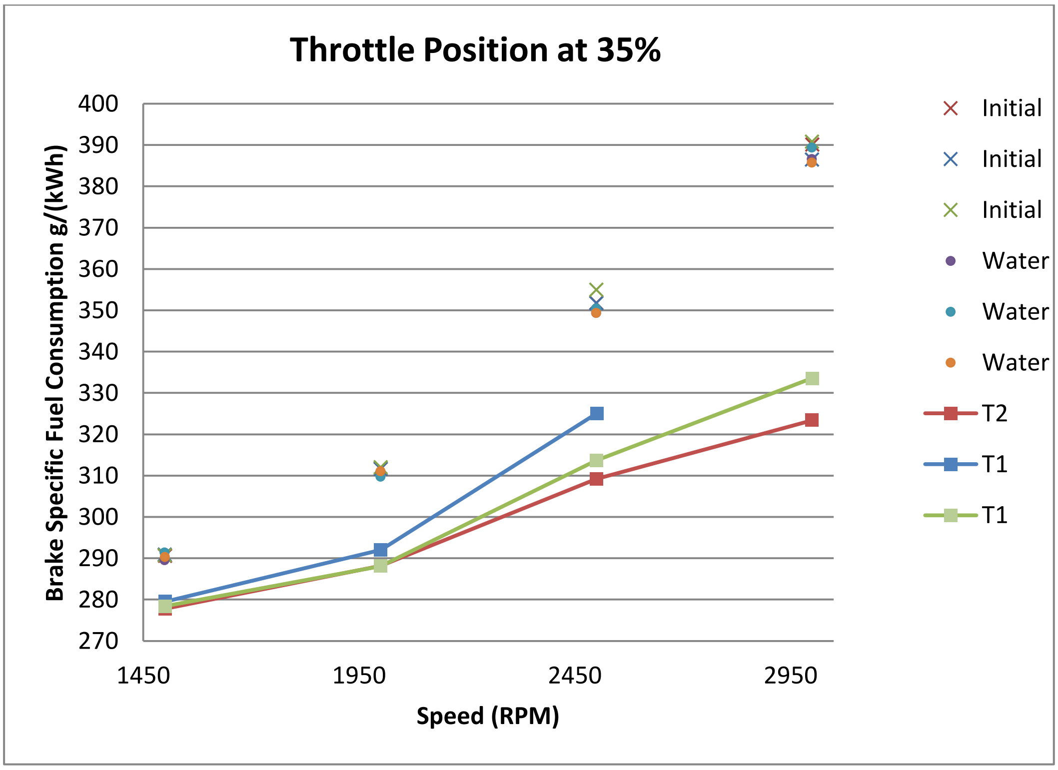
AVL

Result

Min. 5% and Max 80% fuel savings!




Throttle Position at 25%
Brake Specific Fuel Consumption g/(kWh)
550
500
450
400
350
300
250
1450
1950
2450
2950
Speed (RPM)
Initial
Initial
Initial
Water
Water
Water
T2
T1
T1


Throttle Position at 35%
Brake Specific Fuel Consumption g/(kWh)
400
390
380
370
360
350
340
330
320
310
300
290
280
270
1450
1950
2450
2950
Speed (RPM)
Initial
Initial
Initial
Water
Water
Water
T2
T1
T1

Fuel Additive Evaluation according to Korean government standard set-up

Conducted by Daelim Technology R&D Institute

Evaluated by Exhaust emission lab, Inha Technical College http://cms.itc.ac.kr/site/car

Date

12th Dec ~ 18th Dec 2014

Initial condition test 12th Dec 2014

T1 Formula injection start 12th Dec 2014

Evaluating the effect of T1 Formula 18th Dec 2014

Test Car

Hyundai NF Sonata Gasoline 2.0 L

92,000 km aged

Test Condition

Dyno Test with 1591 kg, Inertia weight

Test Mode

<u>Constant Speed Mode</u>

40 ~ 70 km/h, Increasing10 km/h (4th gear) for consumption test

60 ~ 120 km/h, Increasing 10 km/h (5th gear) for consumption test

<u>CVS 75 Mode</u> (equivalent to FTP 75 Mode in the USA) for NOx test

Hot -start (Pre-warmed)

Test Method

After evaluating the initial condition

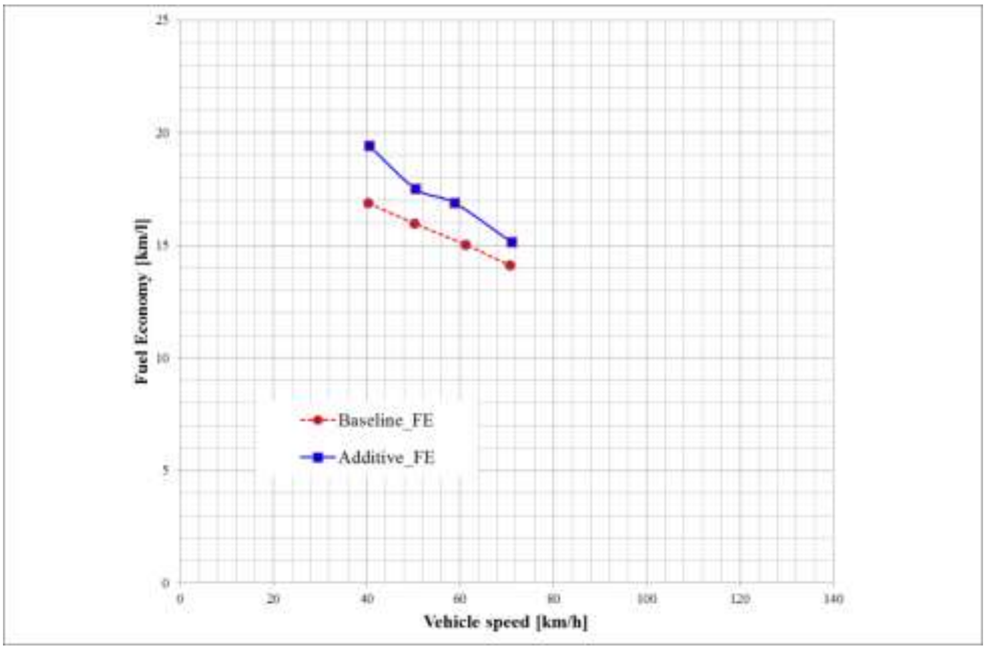
T1 Formula was injected and performed 300 km for 1 week on the road

After the field aging, T1 Formula was injected and performed evaluation.

Test Result

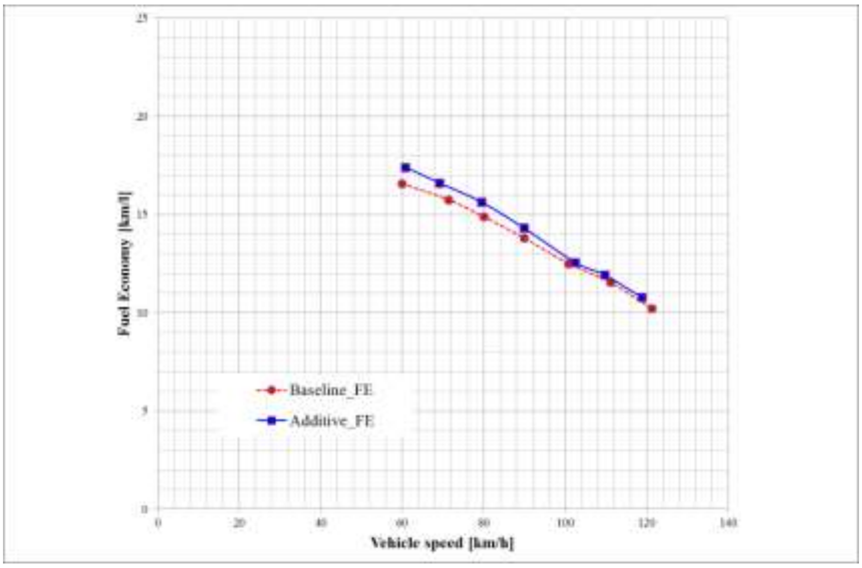
For the 4th gear

Speed [km/h]	40	50	60	70
Baseline FE [km/l] (a)	16.9	16.0	15.1	14.2
Additive FE [km/l] (b)	**19.4**	**17.8**	**16.7**	**15.3**
%Difference = (b-a)/a	+14.6%	+11.4%	+10.6%	+7.9%

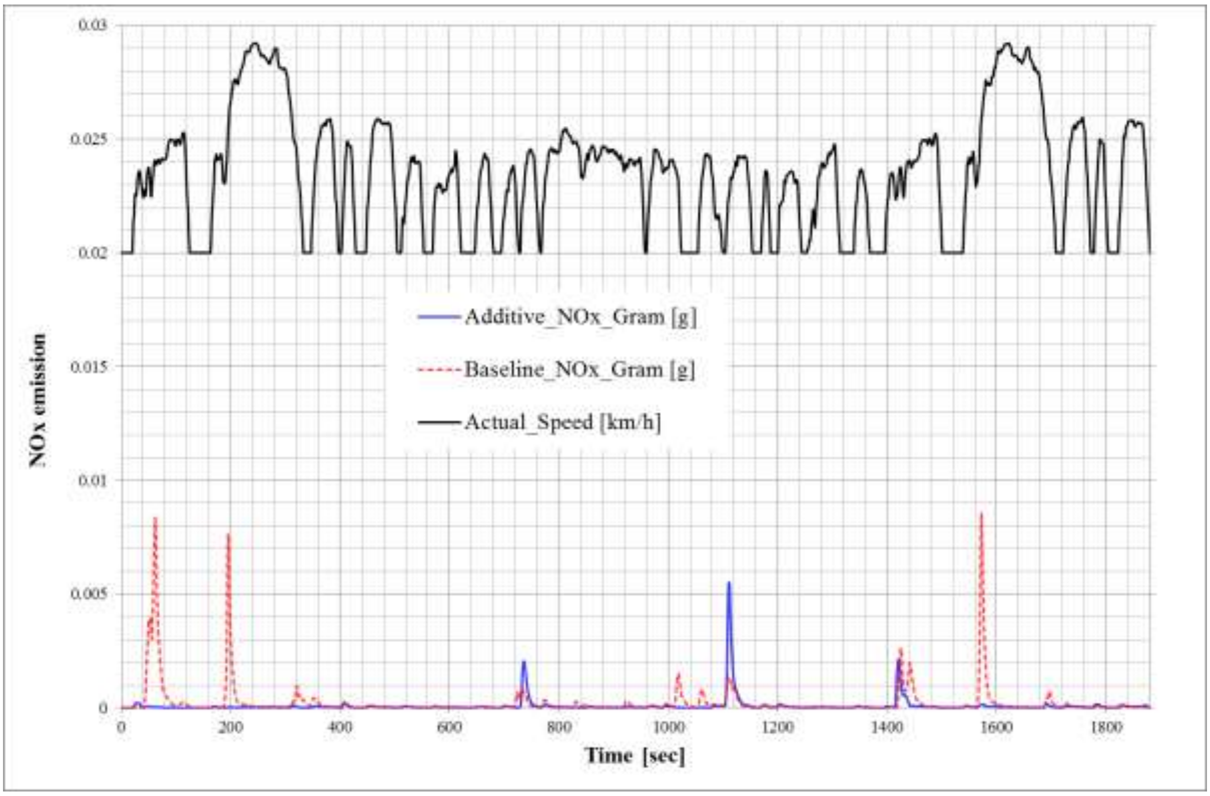


For the 5th gear

Speed [km/h]	60	70	80	90	100	110	120
Baseline FE [km/l]	16.5	15.6	14.6	13.5	12.4	11.1	9.8
Additive FE [km/l]	**17.6**	**16.8**	**15.7**	**14.6**	**13.2**	**12.4**	**11.3**
%Difference = (b-a)/a	+6.8%	+7.8%	+7.9%	+8.2%	+7.0%	+11.4%	+15.4%



CVS 75 Mode (equivalent to FTP 75 Mode)



T1 Formula reduces NOx emission by 50%.

Date

20th ~ 28th June 2014

Initial condition test 20th June 2014

Evaluating the effect of T1 Formula on 28th June 2014

Test Car

Kia Soul Gasoline 1.6 L

Automatic Transmission

20,000 km aged

Test Condition

Dyno Test with 1591 kg, Inertia weight

Test Mode

<u>Constant Speed Mode</u>

40 ~ 120 km/h, Increasing 10 km/h for consumption test

<u>CVS 75 Mode</u> (equivalent to FTP 75 Mode in the USA) for CO and NOx test

Hot -start (Pre-warmed)

Test Method

After evaluating the initial condition the car was not used for 8 days.

No field aging was performed.

T1 Formula was injected instantly and tested.

Test Result

Speed (Km / h)	Baseline Fuel Efficiency (Km/L)	T1 Injection Fuel Efficiency (Km/L)	Fuel Saving (%)
40	17.0	23.1	36
50	19.4	21.8	12.7
60	19.0	22.5	18.4
70	19.5	21.1	8.2
80	18.9	19.3	2.2
90	16.9	17.1	0.9
100	14.8	15.2	2.8
110	12.7	12.9	1.5
120	11.2	11.6	3.6

CVS 75 Mode (equivalent to FTP 75 Mode)

	CO (mg/Km)	NOx (mg/Km)
Baseline	134	7
T1 Injection	114 **15% reduced**	3 **57% reduced**

T1 Formula reduces CO and NOx emissions together.

Field Test Results

1. Tests with commercial cars

Iveco Stralis 420PS

Average Consumption with 100,000 Km before T1 injection: 31.2 L/ 100 Km
Tested Route: Luxembourg - Germany - Belgium - Netherlands
<u>Fuel Save with T1 injection through air intake:12% with 2,500 Km test</u>
<u>Fuel Save with T1 injection through fuel mixture: 10.5% with 2,500 Km test</u>

Hyundai Starex Van 2497cc

Manual Transmission
Official fuel consumption 8.6 L/ 100 Km
Tested Method:
134 Km route mixing Urban & Extra-urban roads in Kyung-Gi, Korea
10 times of on the route before T1 and 10 times on the same route with T1 injection
Average consumption before T1 injection: 8.43 L/ 100 Km
Average consumption with T1 injection: 7.95 L/ 100 Km
<u>Fuel Save: 6.1%</u>

Testing Company: Recon Waste

Tested Car: Volve FH500, 2015 production

Tested Route:
Armagh - M1 - M50 - N7 - Naas (Empty) 168 km
Naas - N7 - M50 - M1 - Armach (2.8 Ton loaded) 168km

Initial Condition

Tested on 29th July 2019
No wind, Average temperature 20C

27.82 Ton loaded:
6.1 mpg (38.6 L/100km) at 65 km/h ~ 6.4 mpg (36.8 L/100km) at 64 km/h

T1 Injection

28.50 Ton loaded
6.6 mpg (35.6 L/100km) at 66 km/h ~ 7.1 mpg (33.1 L/100km) at 72 km/h
8 ~ 10% fuel savings despite the load was 2.5% heavier than the initial test.

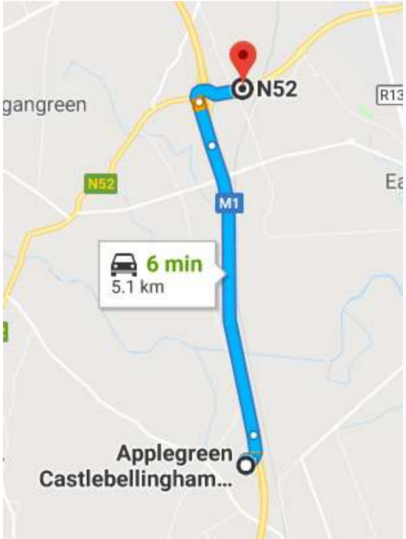
2. Tests with diesel passenger cars

Skoda Octavia 110PS

Initial Condition Test Date: 22nd March 2019
T1 Injection Condition Test Date: 23rd March 2019

Route for Consumption Test:
M50 & M1 Dublin North - Castlebellingham 67km

Route for Emission Test
M1 Applegreen station to N52 5Km



Initial Condition 22.03.2019

Total Weight (kg) Driver + Monitor	Driving Direction	Ave. Speed (km/h)	Temp. (°C)	Road Condition	Wind (knot) Condition	Fuel Cons. (L/100km)
150	North	95 (min 85 ~ max 105)	9.5	Good	7-10 West Gentle breeze	4.3
150	South	97 (min 85 ~ max 105)	11	Good	7-10 West Gentle breeze	4.3

Idle		30 km/h		50 km/h		100 km/h	
CO (ppm)	NOx (ppm)	CO (ppm)	NOx (ppm)	CO (ppm)	NOx (ppm)	CO (ppm)	NOx (ppm)
316	133	300	123	74	64	84	67

T1 Injection 23.03.2019

Test 1

Total Weight (kg) Driver + Monitor	Driving Direction	Ave. Speed (km/h)	Temp. (°C)	Road Condition	Wind (knot) Condition	Fuel Cons. (L/100km)
150	North	92 (min 85 ~ max 105)	10.5	Good	5 North Light breeze	3.9

150	South	93 (min 85 ~ max 105)	11	Good	4 North Light breeze	3.9

Test 2

Total Weight (kg) Driver + Monitor	Driving Direction	Ave. Speed (km/h)	Temp. (^{o}C)	Road Condition	Wind (knot) Condition	Fuel Cons. (L/100km)
150	North	92 (min 85 ~ max 105)	10.5	Good	2 North Light air	3.7
150	South	91 (min 85 ~ max 105)	10	Good	4 North Light breeze	3.7

Idle		30 km/h		50 km/h		100 km/h	
CO (ppm)	NOx (ppm)	CO (ppm)	NOx (ppm)	CO (ppm)	NOx (ppm)	CO (ppm)	NOx (ppm)
96	0	71	0	34	0	37	0

Conclusion:

T1 Fuel save: 9 - 14%

T1 CO reduction: 50-70%

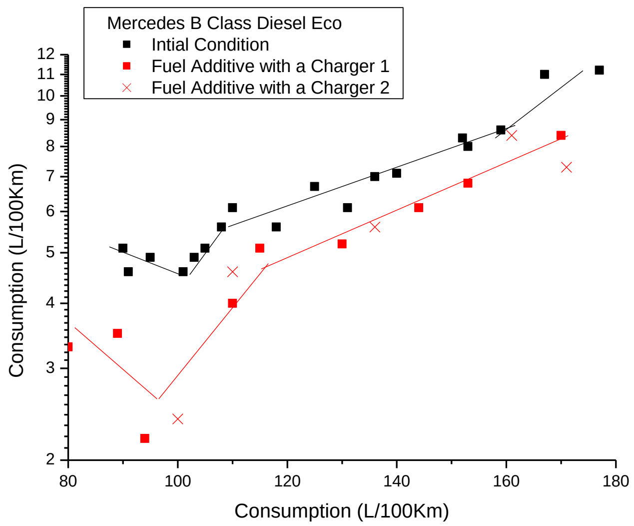
T1 NOx reduction: 100%

Smart forfour 109PS

Manual Transmission
Official consumption
Urban: 6.3 L/ 100 Km, Extra-urban: 4.1 L/ 100 Km, Combine: 4.6 L/ 100 Km
Tested Road: Salzburg, Austria - Düsseldorf, Germany
Distance: 800 Km
Average speed: 100 Km/h
Average consumption before T1 injection: 5.2 L/ 100 Km
Average consumption with T1 injection: 4.7 L/ 100 Km
Fuel Save: 9.6 %

Mercedes B200 136PS
Manual Transmission
Official consumption
Urban: 5.8 L/ 100 Km, Extra-urban: 3.4 L/ 100 Km, Combine: 4.4 L/ 100 Km
Tested Route: Motorway Düsseldorf Germany - Roermond, Netherlands
Tested Method: Keeping constant speed for 5 min at each speed point.

- **47 %** save at 95 Km/h
- **18.7 %** save between 110 - 160 Km/h



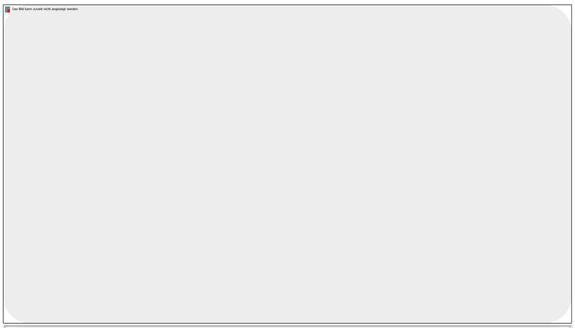
BMW 520d 2000cc
Automatic Transmission
Official consumption
Urban: 5.7 L/ 100 Km, Extra-urban: 4.2 L/ 100 Km, Combine: 4.8 L/ 100 Km

Tested Method:
120 Km urban roads in Kyung-Gi, Korea, average speed 50 km/h
1 time of the route before T1 and 6 times of the same route with T1 injection
Average consumption before T1 injection: 5.38 L/ 100 Km
Average consumption with T1 injection: 4.98 L/ 100 Km
<u>Fuel Save: 8%</u>

Ford Mondeo 140 PS
Automatic Transmission
Official consumption
Urban: 9.8 L/ 100 Km, Extra-urban: 5.6 L/ 100 Km, Combine: 7.2 L/ 100 Km

Tested Route 1: City driving in Düsseldorf for each test
Driving time: 45min
Average speed: 45 Km/h
Consumption before T1: 7.2 L/ 100 Km
Consumption with T1 injection through fuel mixture: 6.8 L/ 100 Km
<u>Fuel Save: 5 %</u>
Consumption with T1 injection through air intake: 5.8 L/ 100 Km
<u>Fuel Save: 19 %</u>

Tested Route 2: Motorway Düsseldorf - Roermond, Netherlands for each test
Distance: 130 Km
Average speed: 95 Km/h
Consumption before T1: 5.75 L/ 100 Km
Consumption with T1 injection through fuel mixture: 5.25 L/ 100 Km
<u>Fuel Save: 9 %</u>
Consumption with T1 injection through air intake: 5.0 L/ 100 Km
<u>Fuel Save: 13 %</u>



3. Tests with gasoline cars

BMW 630i 3.0L Convertible
Automatic Transmission
Official consumption
Urban: 12.5 L/ 100 Km, Extra-urban: 7.0 L/ 100 Km, Combine: 8.7 L/ 100 Km
Tested Route
209 Km M6 & M4 from Galway to Dublin, Ireland
Average speed: 95 Km/h
Consumption with T1 injection: 6.1 L/ 100 Km
<u>Fuel Save: 12.8%</u>

Mini Cooper 1.8L Convertible
Manual Transmission
Official consumption
Urban: 10.1 L/ 100 Km, Extra-urban: 5.7 L/ 100 Km, Combine: 7.3 L/ 100 Km

Tested Route 1: 100 Km N11 & M11 Wicklow - Dublin, Ireland
Average Speed 95 Km/h
Consumption before T1: 6.1 L/ 100 Km
Consumption with T1 injection : 5.4 L/ 100 Km
<u>Fuel Save: 11%</u>

Tested Route 2: 80 Km M4 & N4 Mullingar - Dublin, Ireland
Average Speed 110 Km/h
Consumption before T1: 7.5 L/ 100 Km
Consumption with T1 injection: 6.9 L/ 100 Km
<u>Fuel Save: 8%</u>

Rigorous Tests with Generators (conducted over 100 times)

Energy production with a 5 kW diesel generator

8.0 % enhancement of energy production with T1 injection through air intake.
T1 injection through air intake **reduces CO emission by 15%**.

4.5% enhancement of energy production with T1 injection through fuel mixture.
T1 injection through direct mixture **reduces NOx emission by 10%.**

Comparison with other market leading products under the same condition as above.

Compared Product	Mixing Method	Fuel saving	CO	NOx
Product D	1% mixing with fuel	2.3%	8% decrease	5% decrease
Product S	0.05% mixing with fuel	1.7%	15% decrease	4% increase
Product E	0.1% mixing with fuel	2.3%	9% decrease	3% increase

Energy Production of a 3 kW gasoline generator

9.5 % enhancement of energy production with T1 injection through air intake.
Notice: Our technology can be optimised for more energy production (fuel saving) or for more reduction of the emissions.

Summary

The following is the summary of the advantages of T1 Formula:

- T1 is applicable to gasoline, diesel and bioethanol combustion engines.
- Only 0.1 ~ 10 mL of T1 is need for 1L of fuel.
- Metal content from T1 involved in the combustion would be less than 0.01ppm.
- T1 is benign to the engine and environment.
- T1 showed average 9% fuel save by real road tests.
- An optimisation of T1 reduced NOx by average 50% on a standard test bench.