

Sustainable Mobility Ethanol Talks Vietnam

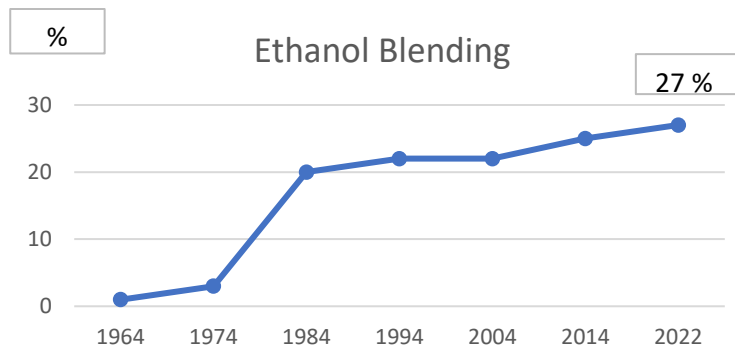
Edson Orikassa



**SUSTAINABLE
MOBILITY:
ETHANOL TALKS
VIETNAM**

1 - Ethanol history in Brazil:

1.1 Timeline:



Remark: Blending started in 1924 and became mandatory in middle of decade of '70

1.2 Decade of 1970 :

- More than 50 years ago the blending raised from 10% to 15%
- It happen along the country, even an old vehicle fleet available before this period
- Octane was improved in 2 or 3 points
- Some improvements was done into vehicles too

1 - Ethanol history in Brazil:

1.3 From decade of '80:

- The blending raise to 20%
- No vehicle problem was detected

1.4 From years 2000 up to now:

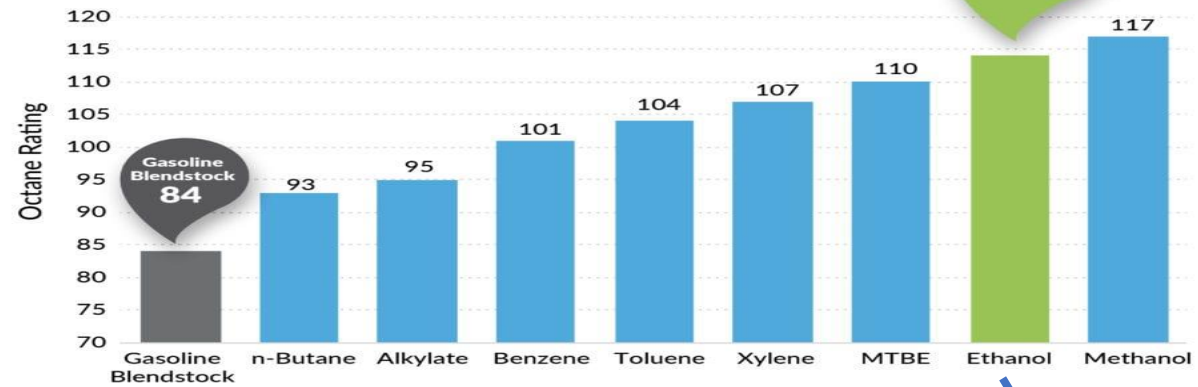
- In the beginning raise to 25% and nowadays is 27%
- Tests were done with 27%, but no problem was detected
- There is some movements in raise it to 30%
- Some studies were already done with 30%, but we shouldn't have problem

2. High Octane Fuel (HOF) - RON

Higher octane allows for higher compression ratios, which increases efficiency and can reduce engine size and speed

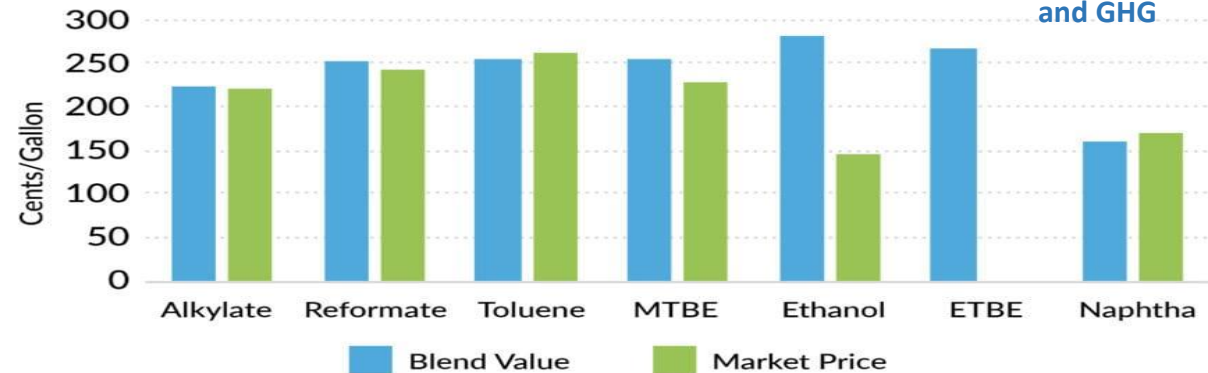
There are octane boosters. The most common ways are to increase aromatics or increase the volume of ethanol

Blending Octane Ratings of Various Gasoline Octane Boosters



Source: Department of Energy

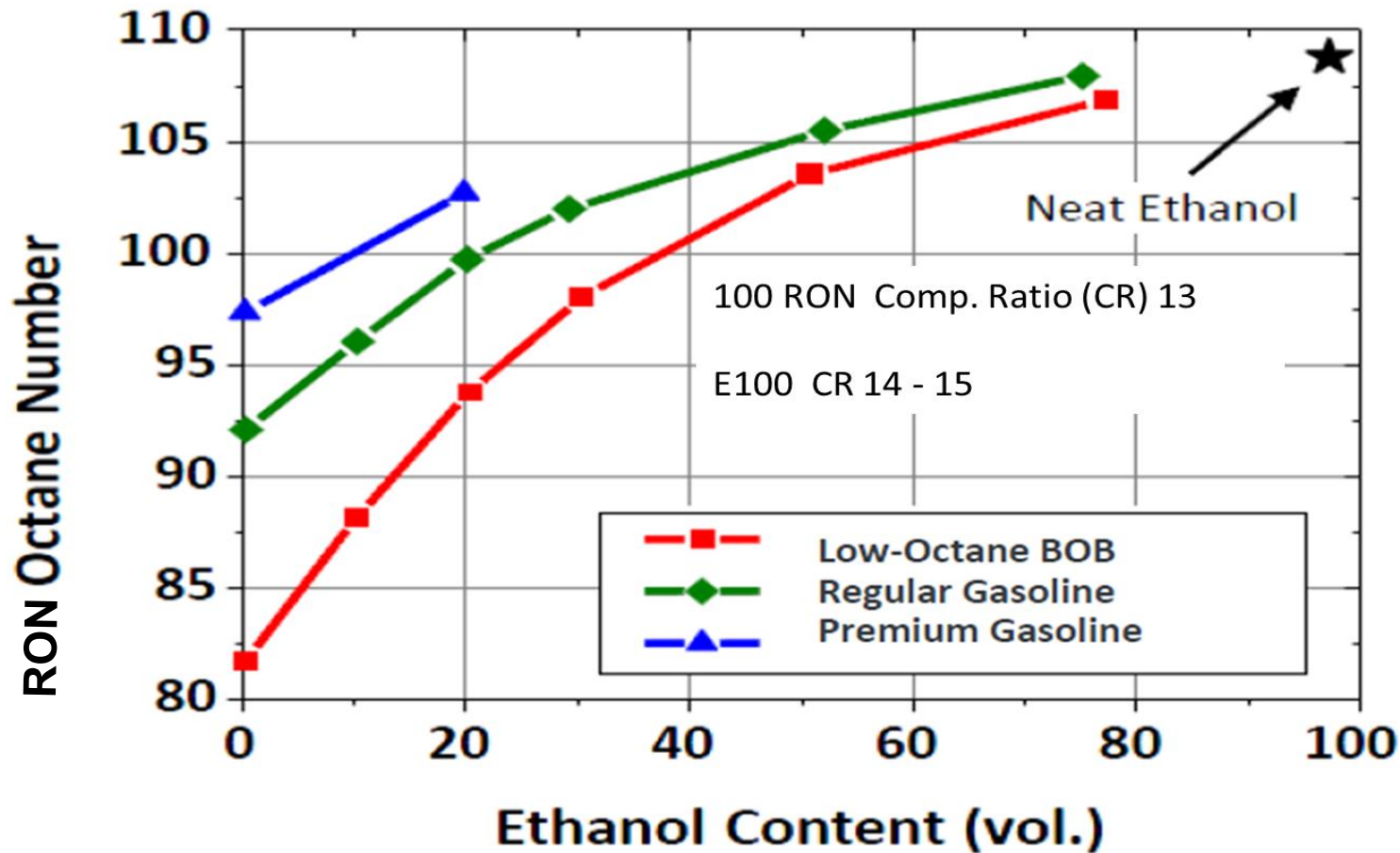
Octane Blending Value vs Market Price



LOWER EMISSION and GHG

Source: Argus Media

2. High Octane Fuel (HOF) - RON



Reproduced from Stein, SAE2012-01-1277

BOB - blendstock for oxygenate blending

3 - Vehicle's history:

3.1 Brazil:



(1931)

Year	
1931	First test
1975	Proálcool – Ethanol Program
1979	FIAT 147 – First Vehicle E100
2003	VW Gol – First FFV
2019	Corolla – First HEV-FFV



(2019)

3.2 World (E85):



E85 FlexFuel Chevrolet Impala LT



E85 FlexFuel Chevrolet HHR LS
2009



E85 Flexfuel van Ford E-250

(EUA)



BMW 320i ActiveFlex



E85 Saab 9-3 SportComi
BioPower, Suécia



Volswagen Kombi TotalFlex

(EU)

4 – Fuel specification:

4.1 Brazil:

CARACTERÍSTICA	UNIDADE	LIMITE		MÉTODO	
		EAC	EHC	NBR	ASTM
Aspecto	-	Límpido e isento de impurezas (Lil)		Visual	
Cor	-	(2)	(3)	Visual	
Acidez total, máx. (em miligramas de ácido acético)	mg/L	30		9866	-
Condutividade elétrica, máx.	µS/m	350		10547	-
Massa específica a 20°C (41)(5) (6)	kg/m ³	791,5máx.	807,6 a 811,0	5992 e 15639	D4052
Teor alcoólico (5) (6) (7) (8)	% volume	99,6 mín.	95,1 a 96,0	5992 e 15639	-
	% massa	99,3 mín.	92,5 a 93,8		
Potencial hidrogeniônico (pH)	-	-	6,0 a 8,0	10891	-
Teor de óxido - min. (9)	% volume	98,0	94,5	-	D5501
Teor de água, máx. (9) (10)	% volume	0,4	4,9	15531 15888	E203
Teor de metanol, máx. (11)	% volume	1		cromatografia	
Resíduo por evaporação, máx. (12) (13)	mg/100 mL	5		8644	-
Goma Lavada (12) (13)	mg/100 mL	5		-	D381
Teor de hidrocarbonetos, máx. (12)	% volume	3		13993	-
Teor de cloro, máx. (12) (14)	mg/kg	1		10894	D7328 D7319
Teor de sulfato, máx. (14) (15)	mg/kg	4		10894	D7328 D7319
Teor de ferro, máx. (14) (15)	mg/kg	5		11331	-
Teor de sódio, máx. (14) (15)	mg/kg	2		10422	-
Teor de cobre, máx. (15) (16)	mg/kg	0,07	-	11331	-

Teor alcoólico (5) (6) (7) (8)	% volume	99,6 mín.	95,1 a 96,0	5992 e 15639	-
	% massa	99,3 mín.	92,5 a 93,8		

4.2 WWFC World Wide Fuel Charter allows E10:

CATEGORY I UNLEADED GASOLINE

Markets with no or first level requirements for emission controls; based primarily on fundamental vehicle/engine performance and protection of emission control system.

PROPERTIES	UNITS	LIMIT	
		Min.	Max.
'91 RON' ⁽¹⁾	Research Octane Number	91,0	
	Motor Octane Number	82,0	
'95 RON' ⁽¹⁾	Research Octane Number	95,0	
	Motor Octane Number	85,0	
'98 RON' ⁽¹⁾	Research Octane Number	98,0	
	Motor Octane Number	88,0	
Oxidation stability	minutes	340	
Sulphur	mg/kg ⁽²⁾		1000
Trace metal ⁽²⁾	mg/kg		1 or non-detectable, whichever is lower
Oxygen ⁽⁴⁾	% m/m		2,7 ⁽⁴⁾
Aromatics	% v/v		50,0
Benzene	% v/v		5,0
Volatility			See Tables, page 8
Unwashed gums	mg/100 ml		70
Washed gums	mg/100 ml		5
Density	kg/m ³	715	780
Copper corrosion	rating		Class 1
Appearance		Clear and bright; no free water or particulates	
Carburettor cleanliness	merit	8,0 ⁽⁴⁾	
Fuel injector cleanliness, Method 1, or	% flow loss		10 ⁽⁴⁾
Fuel injector cleanliness, Method 2	% flow loss		10 ⁽⁴⁾
Intake valve cleanliness	merit	9,0 ⁽⁴⁾	

Footnotes:

- ⁽¹⁾ Three octane grades are defined for maximum market flexibility; availability of all three is not needed.
⁽²⁾ The unit mg/kg is often expressed as ppm. Lower sulphur content preferred for catalyst-equipped vehicles.
⁽³⁾ Examples of trace metals include, but are not limited to, Cu, Fe, Mn, Ni, P, Pb, Si and Zn. Another undesirable element is Cl. Metal-containing additives are acceptable only for valve seat protection in non-catalyst cars; in this case, potassium-based additives are recommended. No intentional addition of metal-based additives is allowed.
⁽⁴⁾ Where oxygenates are used, others are preferred. Methanol is not permitted.
⁽⁵⁾ By exception, up to 10% by volume ethanol content is allowed if permitted by existing regulation. Blendstock ethanol should meet the E100 Guidelines published by the WWFC Committee. Fuel pump labelling is recommended for gasoline-ethanol blends to enable customers to determine if their vehicles can use the fuel.
⁽⁶⁾ Compliance with this requirement can be demonstrated by the use of proper detergent additives in comparable-base gasolines.

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ACEA - European Automobile Manufacturers' Association




Japan Automobile Manufacturers Association (JAMA)

5 - Conclusions:

5.1 Brazil:

- Huge and positive economic & social impact
- In job creation
- Technological development
- Environment improvement
- Excellent option for the electrification process in transport

5.2 World:

- Environmental debate
- Sustainable Fuel
- Finite fossil fuel
- Job generation

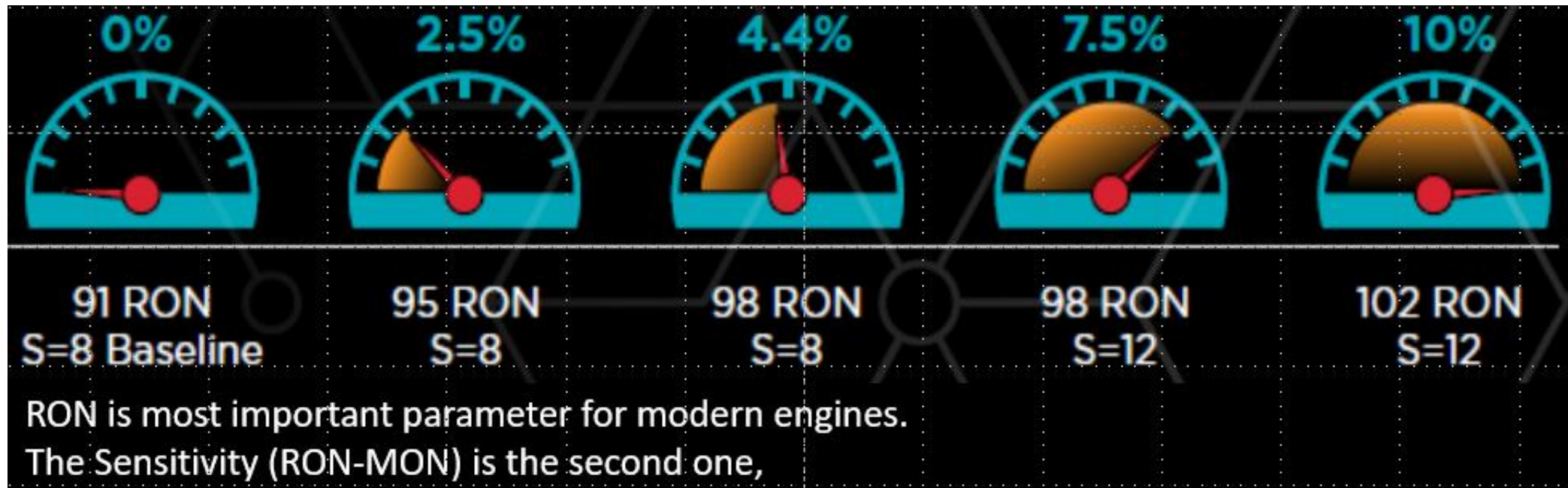
Cảm ơn rất nhiều
Thank you very much

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Backup:

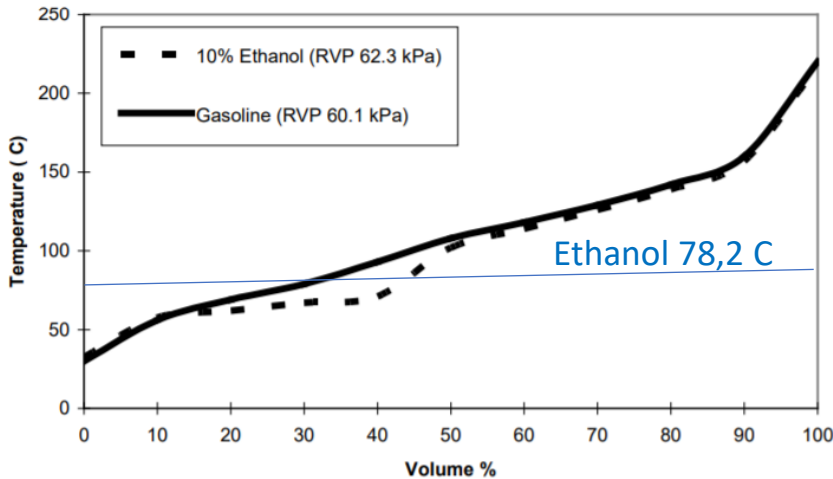
Effects of improving Octane properties RON and Sensitivity

MON-Motoring Octane Number was the original method to indicate knocking resistance. For downsized, down speed (rpm) and high compression ratios engines RON-Research Octane Number is more indicated



Differences between Gasoline and Ethanol Properties

• Destillation

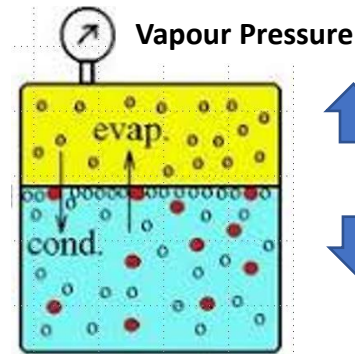


Up to 10% by volume no notable effect on adjustment.

Above it the injection and combustion sensors must learn the new % and adjust to it.

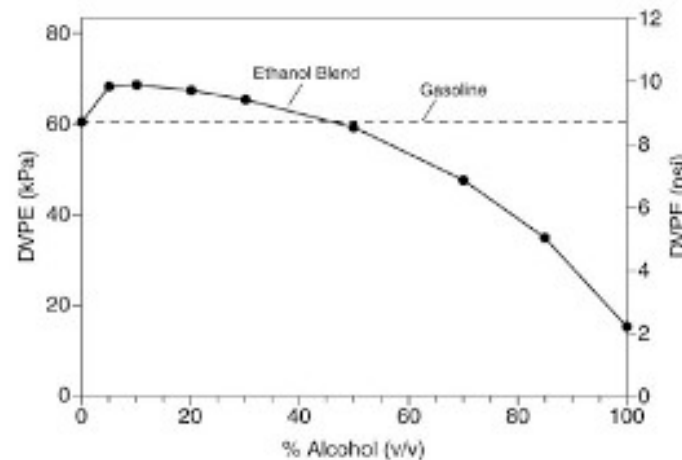
Current systems are able to control up to E25

• Vapour Pressure



↑ Vapour Lock

↓ Cold Start Problems



• Energy Content

Ethanol has around 70% of gasoline energy content by volume
Ethanol blends will have lower energy than E0.
It could cause with E10 around 3% lower range, but it can be offset by the higher RON, even on existing vehicles.

All combinations will be needed for low Carb Society



HC



Elect.



H₂



Bio

Ethanol allows
a quick and
sustainable
transition

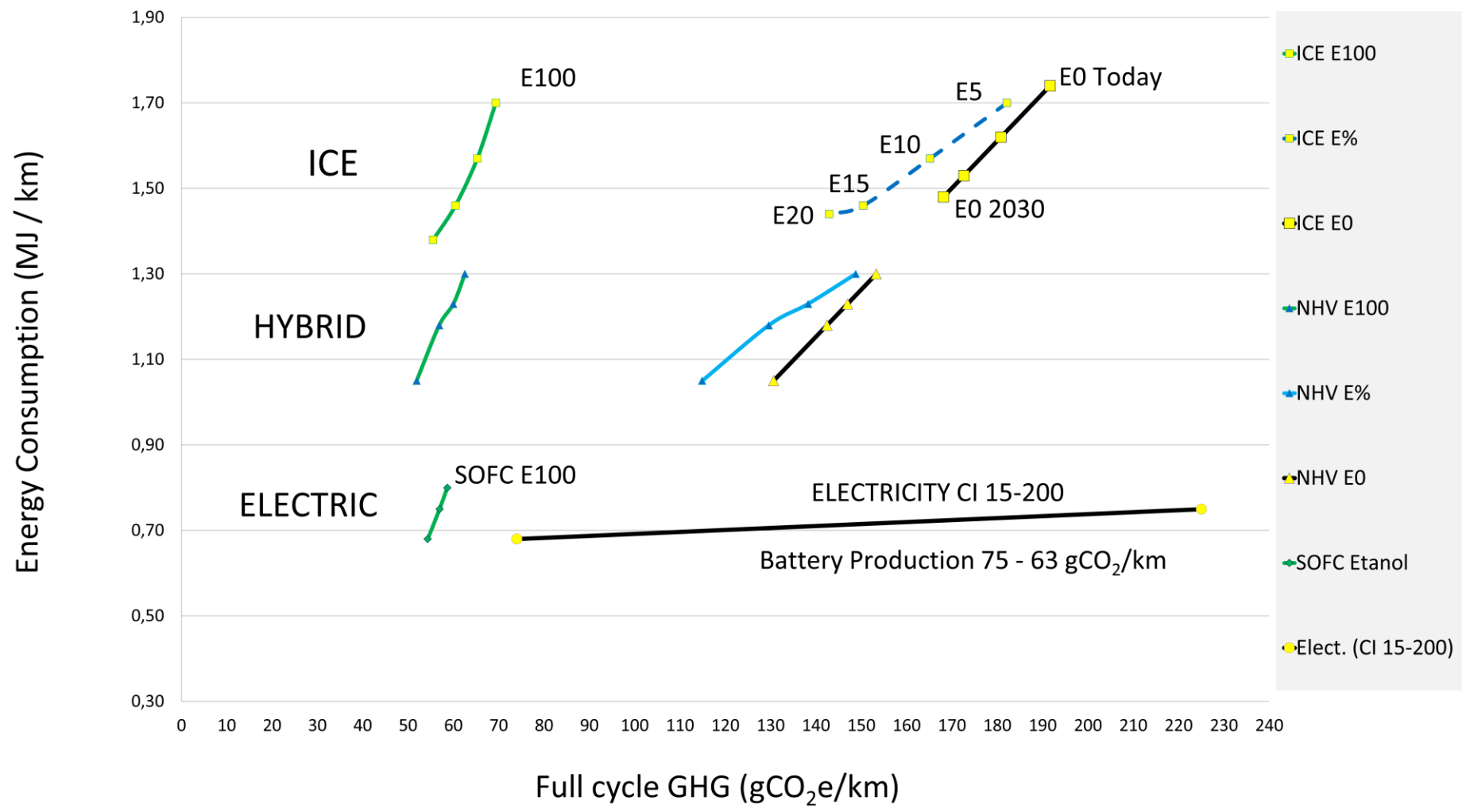
HC + Bio: extends fossil fuel usefull life with lower GHG

HC + Elect.: with small battery reduces GHG by lowering HC consumption

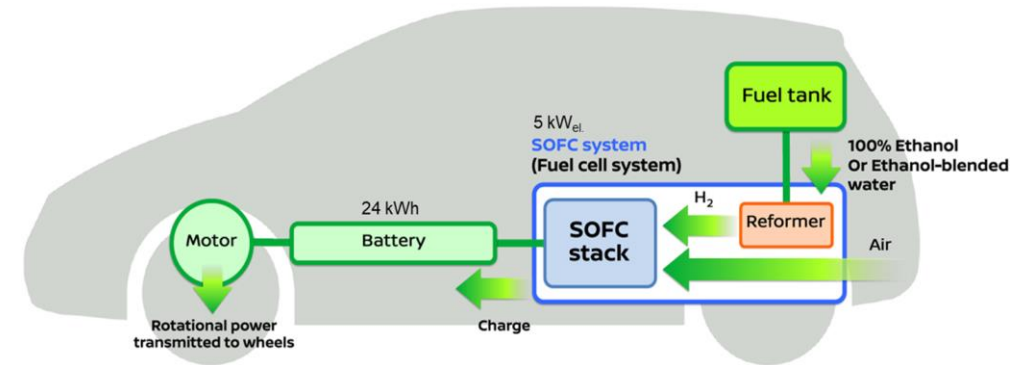
Elect.+H₂: Fuel Cell improves Electric cars GHG by reducing battery size

Elect.+H₂ + Bio: Ethanol Fuel Cell, renewable, efficient and low GHG

Vehicle Full Cycle GHG= Well-to-Wheel GHG + (Vehicle + Battery Production) GHG (gCO₂e/km)



Flex Hybrid - Electrification is not "Batteryzation"



Ethanol is "liquid Hydrogen" when used in a Fuel Cell, eliminating the high cost 700 bar reservoirs and it is renewable!

Ethanol as a rapid transition to a low carbon society

