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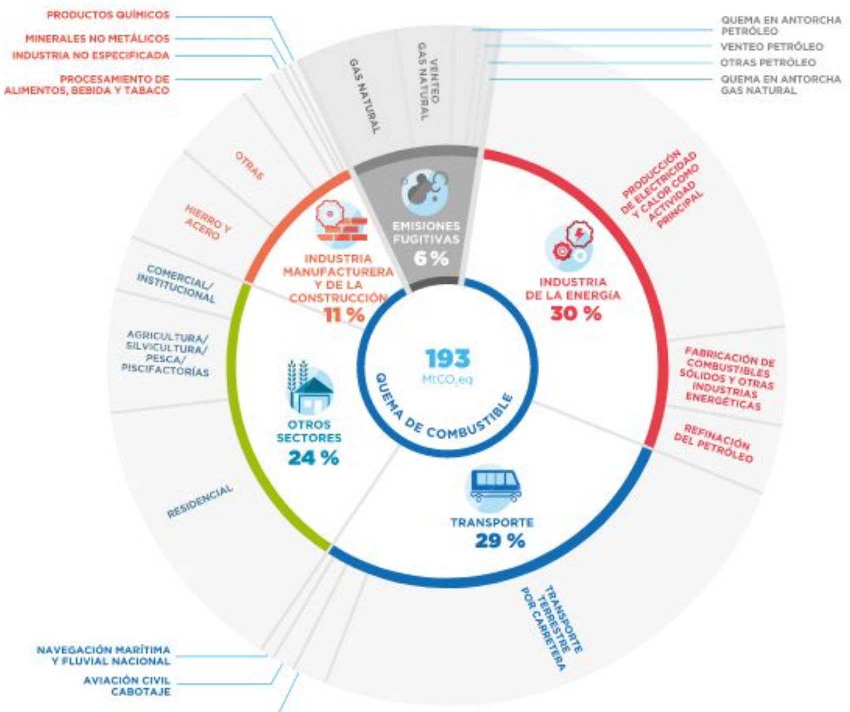
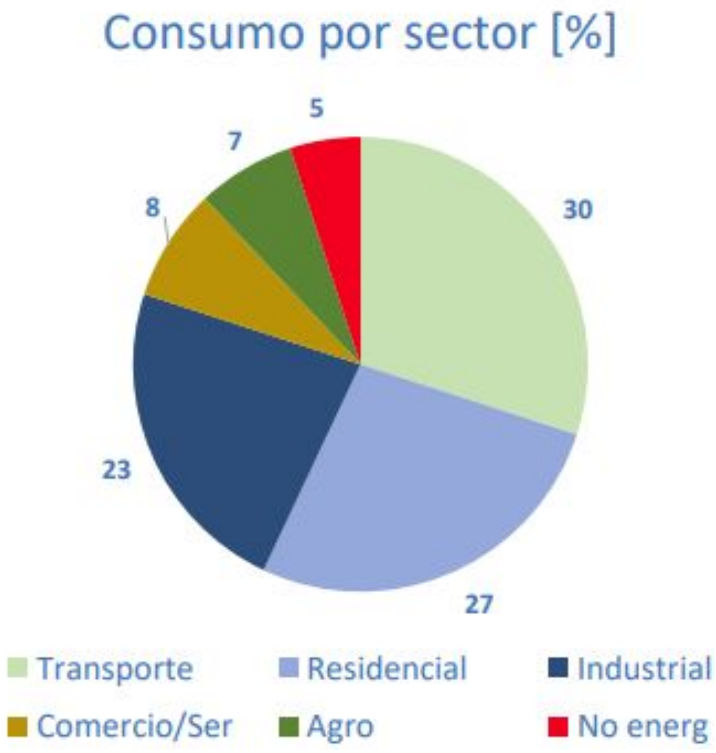
LabSHyL

Laboratorio de Sistemas de Hidrógeno y Litio

Relación Energía-Transporte



Fuente: Segundo BUR, Ministerio de Ambiente y Desarrollo Sustentable.

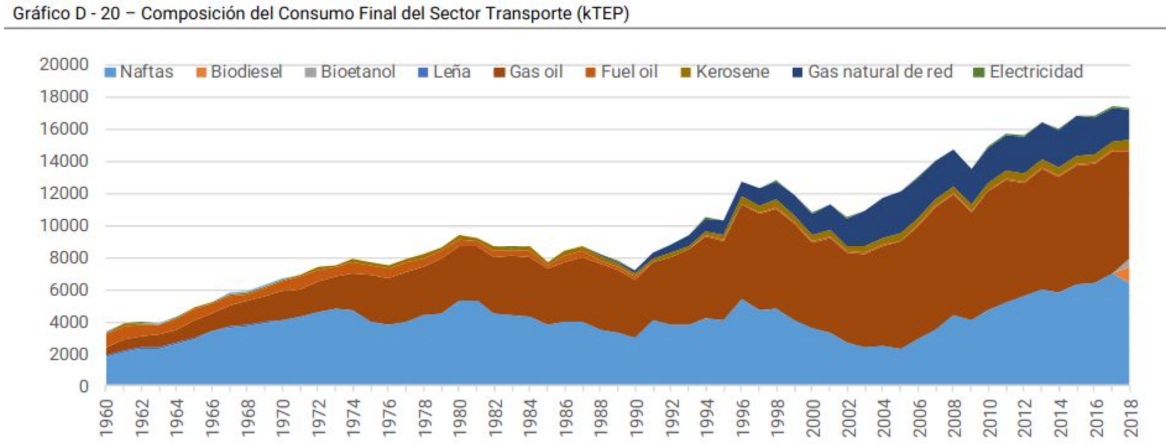


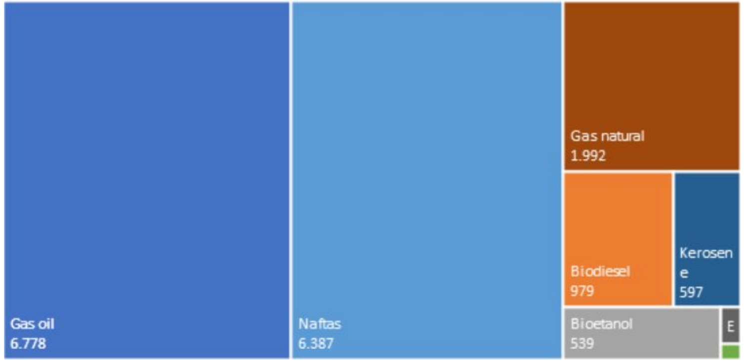
Los costos económicos para la sociedad provenientes de la contaminación ambiental por PM sobrepasa el 3.7% del producto interno bruto

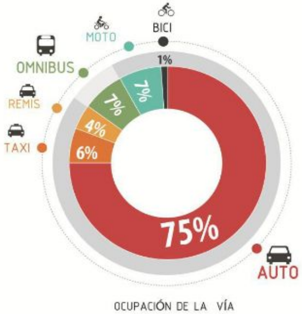
Se estimó, de manera conservadora, que las emisiones de motores y vehículos podían asociarse a casi 1000 muertes prematuras relacionadas a la contaminación atmosférica durante 2015 (Anenberg, Miller, Henze, Minjares, & Achakulwisut, 2019).

Sector transporte en Argentina

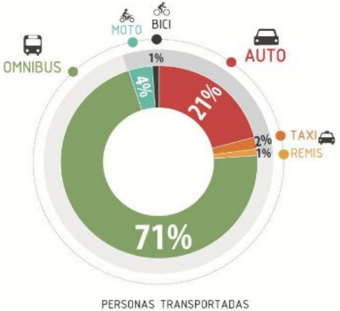
Los Biocombustibles se incorporan al sector Transporte a partir del año 2018



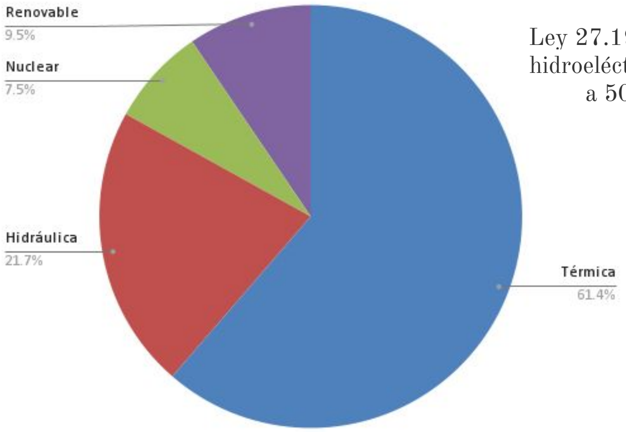




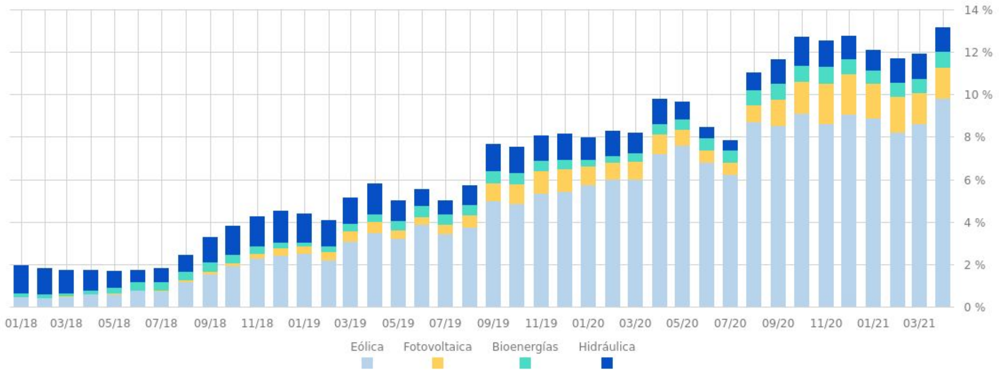
Autos: 60 autos - 72 personas, 1,2 personas por auto, ocupando 1000 m^2.
Bicicleta: 72 personas, ocupando un total 90 m^2.
Colectivos : 72 personas en 1 colectivo, 30 m^2.

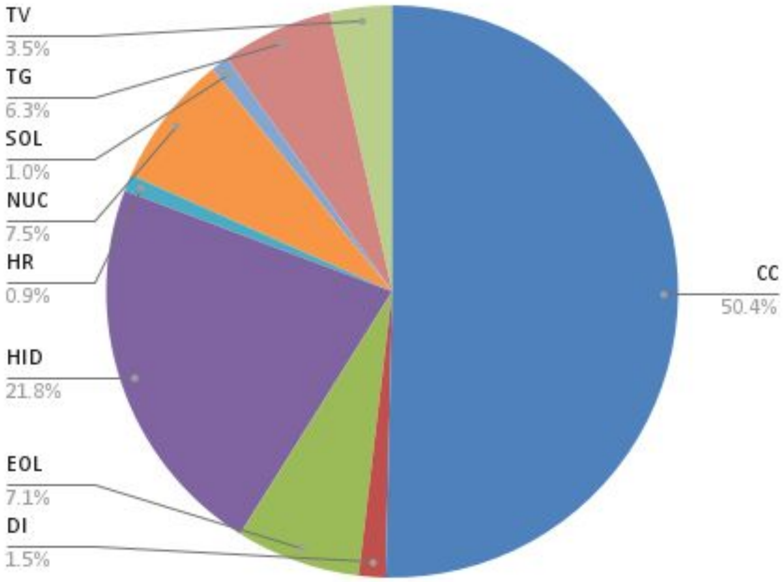


Matriz eléctrica Argentina

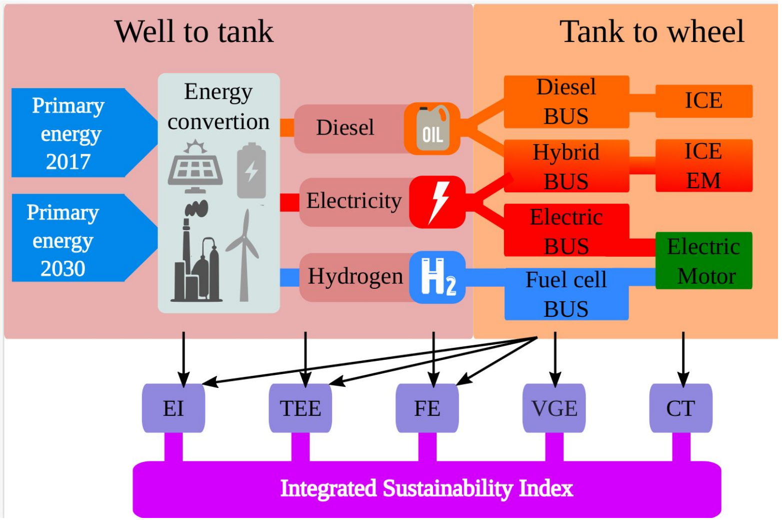


Ley 27.191, esto es, hidroeléctrica menor a 50 MW

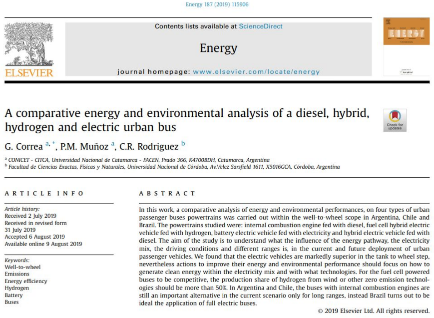




Del pozo a la rueda



A comparative energy and environmental analysis of a diesel, hybrid,hydrogen and electric urban bus



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A comparative energy and environmental analysis of a diesel, hybrid, hydrogen and electric urban bus

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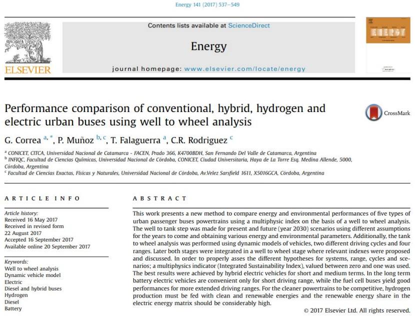
ABSTRACT

In this work, a comparative analysis of energy and environmental performances, on four types of urban passenger buses powertrains was carried out within the well-to-wheel scope in Argentina, Chile and Brazil. The powertrains studied were: internal combustion engine fed with diesel, fuel cell hybrid electric vehicle fed with hydrogen, battery electric vehicle fed with electricity and hybrid electric vehicle fed with diesel. The aim of the study is to understand what the influence of the energy pathway, the electricity mix, the driving conditions and different ranges is, in the current and future deployment of urban passenger vehicles. We found that the electric vehicles are markedly superior in the tank to wheel step, nevertheless actions to improve their energy and environmental performance should focus on how to generate clean energy within the electricity mix and with what technologies. For the fuel cell powered buses to be competitive, the production share of hydrogen from wind or other zero emission technologies should be more than 50%. In Argentina and Chile, the buses with internal combustion engines are still an important alternative in the current scenario only for long ranges, instead Brazil turns out to be ideal the application of full electric buses.

Performance comparison of conventional, hybrid, hydrogen and electric urban buses using well to wheel analysis



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Performance comparison of conventional, hybrid, hydrogen and electric urban buses using well to wheel analysis

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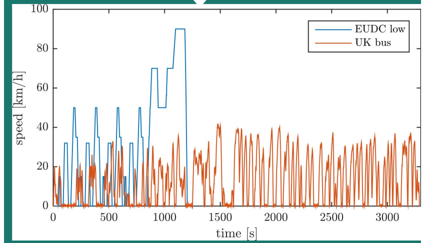
ABSTRACT

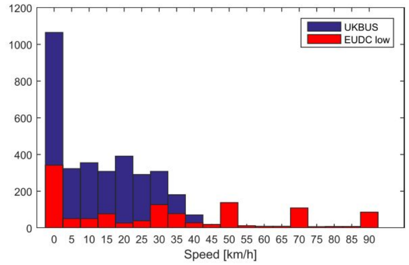
This work presents a new method to compare energy and environmental performances of five types of urban passenger buses powertrains using a multiphysic index on the basis of a well to wheel analysis. The well to tank step was made for present and future (year 2030) scenarios using different assumptions for the years to come and obtaining various energy and environmental parameters. Additionally, the tank to wheel analysis was performed using dynamic models of vehicles, two different driving cycles and four ranges. Later both stages were integrated in a well to wheel stage where relevant indexes were proposed and discussed. In order to properly asses the different hypotheses for systems, range, cycles and scenarios; a multiphysics indicator (Integrated Sustainability Index), valued between zero and one was used. The best results were achieved by hybrid electric vehicles for short and medium terms. In the long term battery electric vehicles are convenient only for short driving range, while the fuel cell buses yield good performances for more extended driving ranges. For the cleaner powertrains to be competitive, hydrogen production must be fed with clean and renewable energies and the renewable energy share in the electric energy matrix should be considerably high.

1

Importancia de los modos de conducción

Se analizaron 2 ciclos de conducción. Urbano e urbano+interurbano



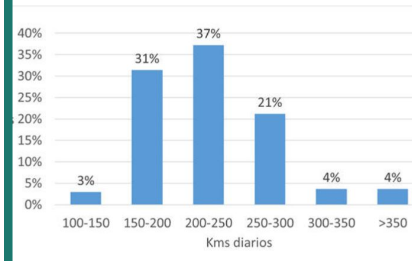


2

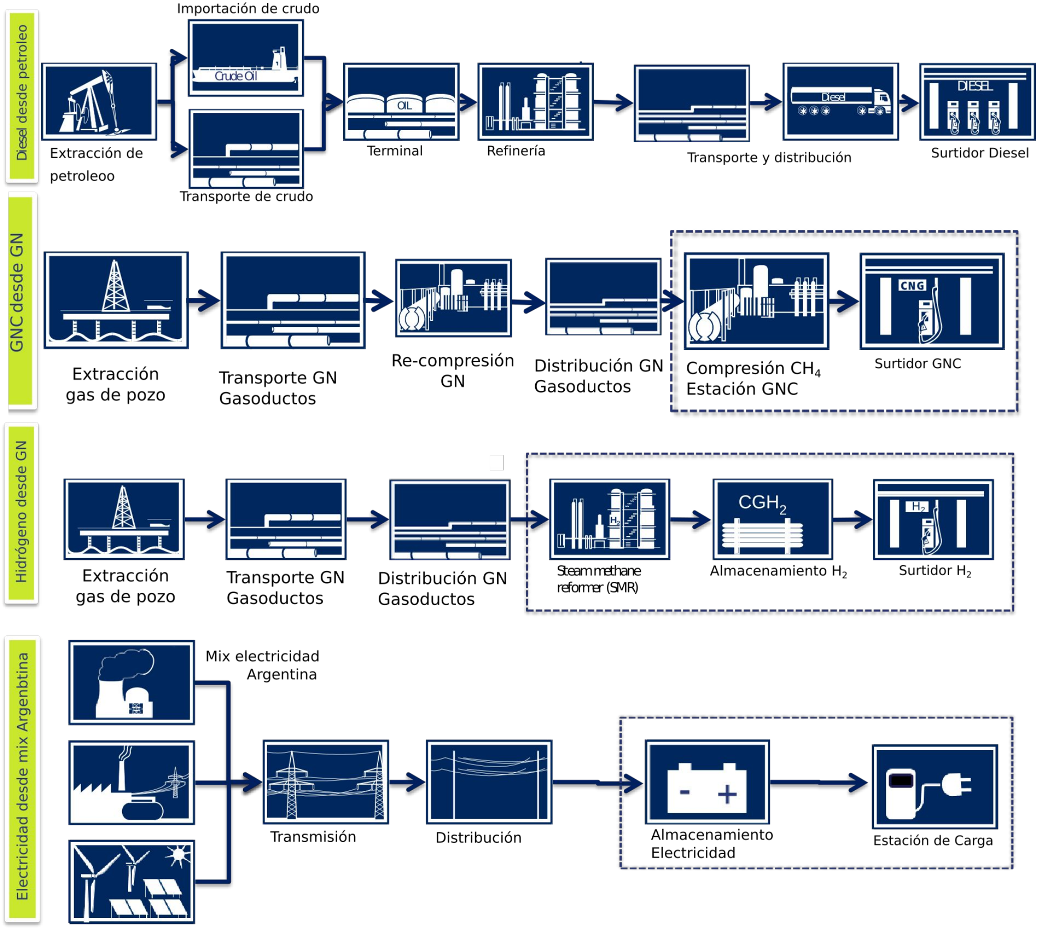
Importancia de los Rangos

Se analizaron 4 rangos: 100, 200, 300 y 400 km

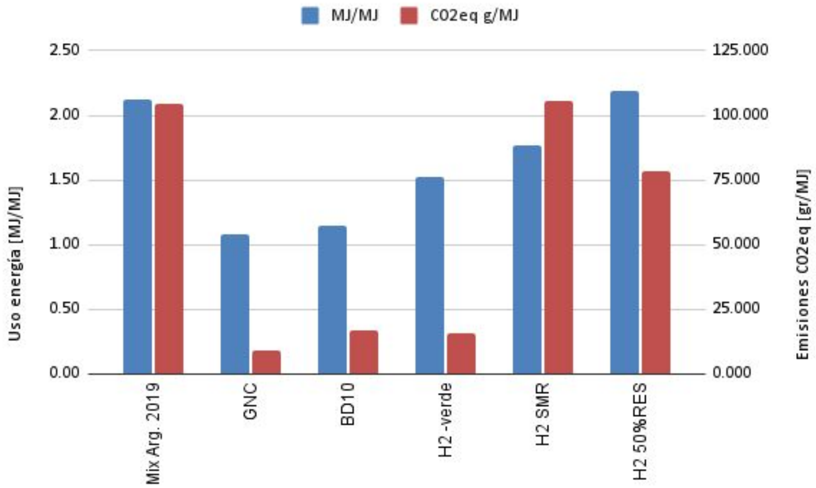
Transporte urbano CBA recorrido de 200 km promedio casi 1000 unidades



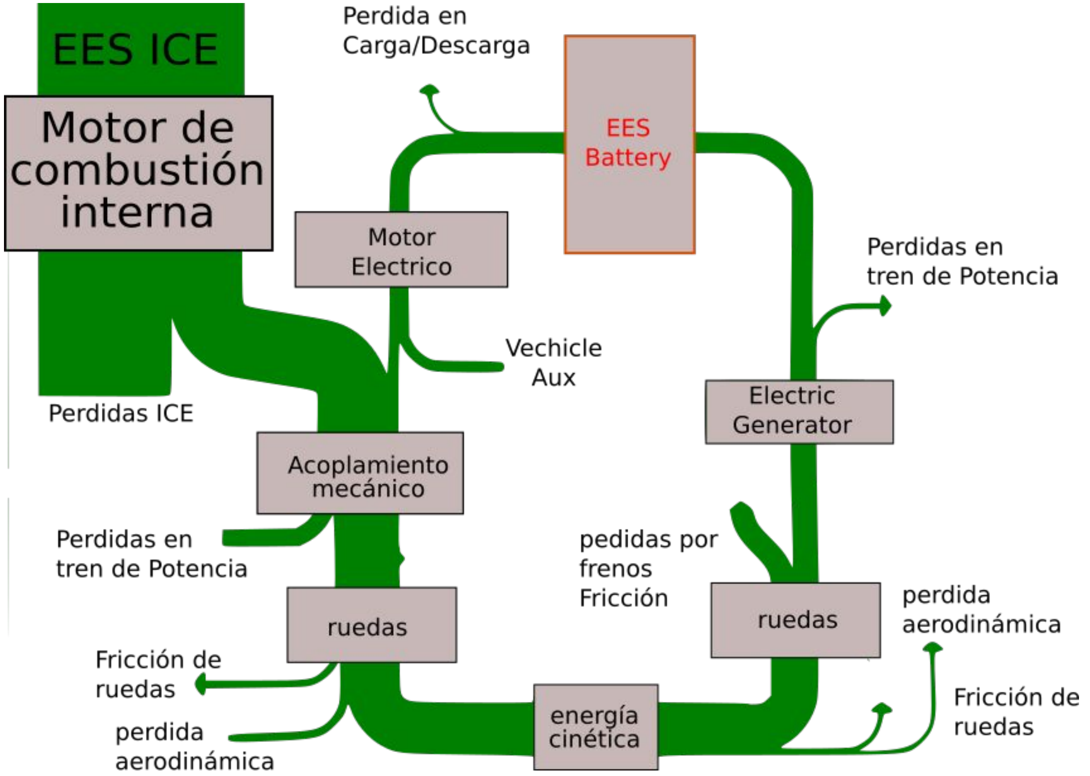
Del pozo al tanque (2017)

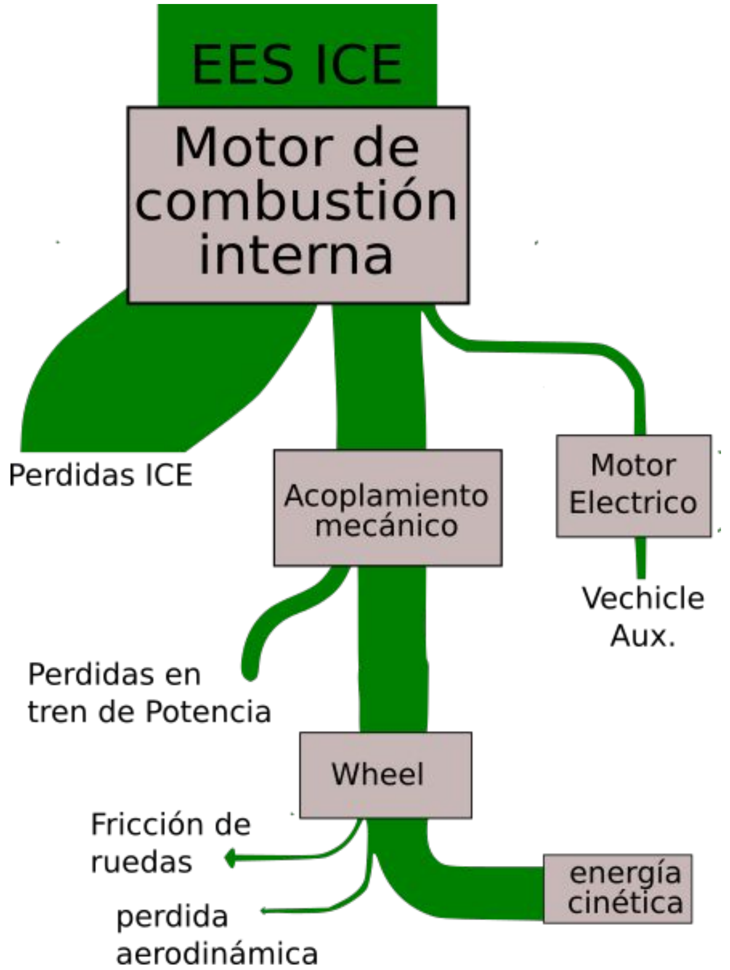


	Mix Arg. 2019	GNC	BD10	**H2** verde	**H2** SMR	**H2** 50RES
Eficiencia %	47.16%	92.92%	87.19%	65.78%	56.54%	45.64%
PM g/MJ	0.019	0.001	0.003	0.003	0.007	0.014
CO2eq g/MJ	104.623	9.176	16.937	15.903	105.489	78.567

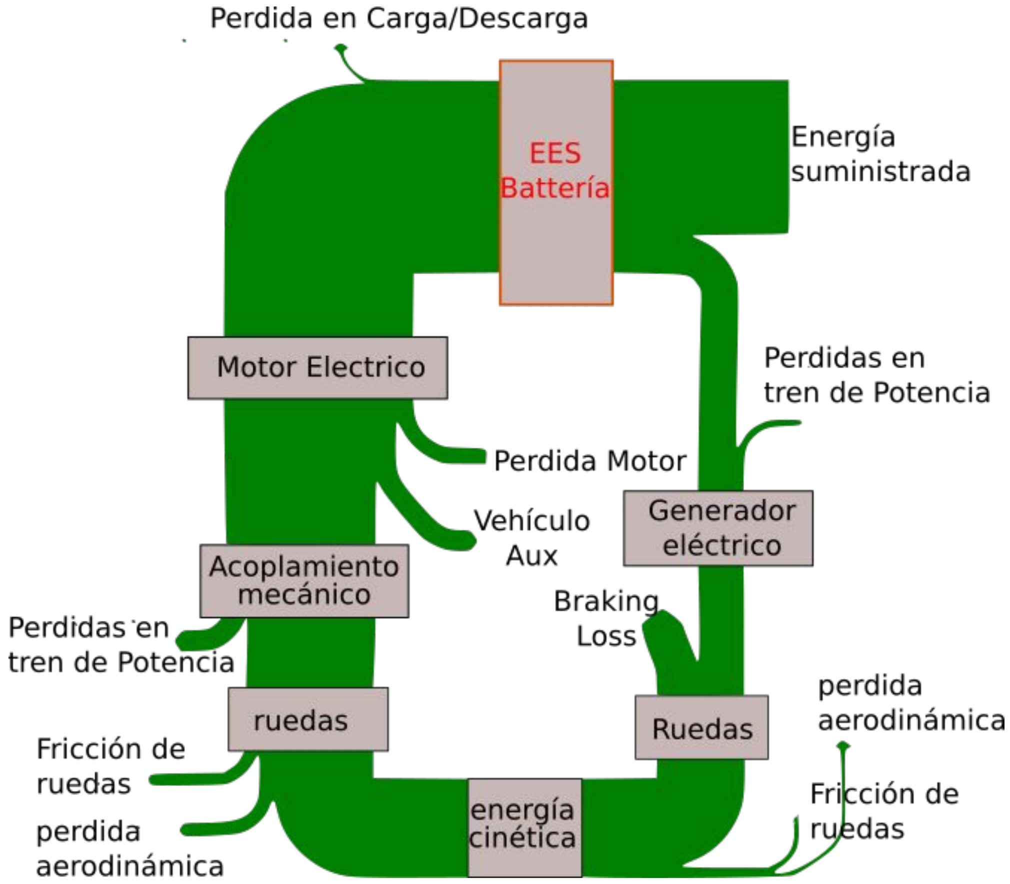


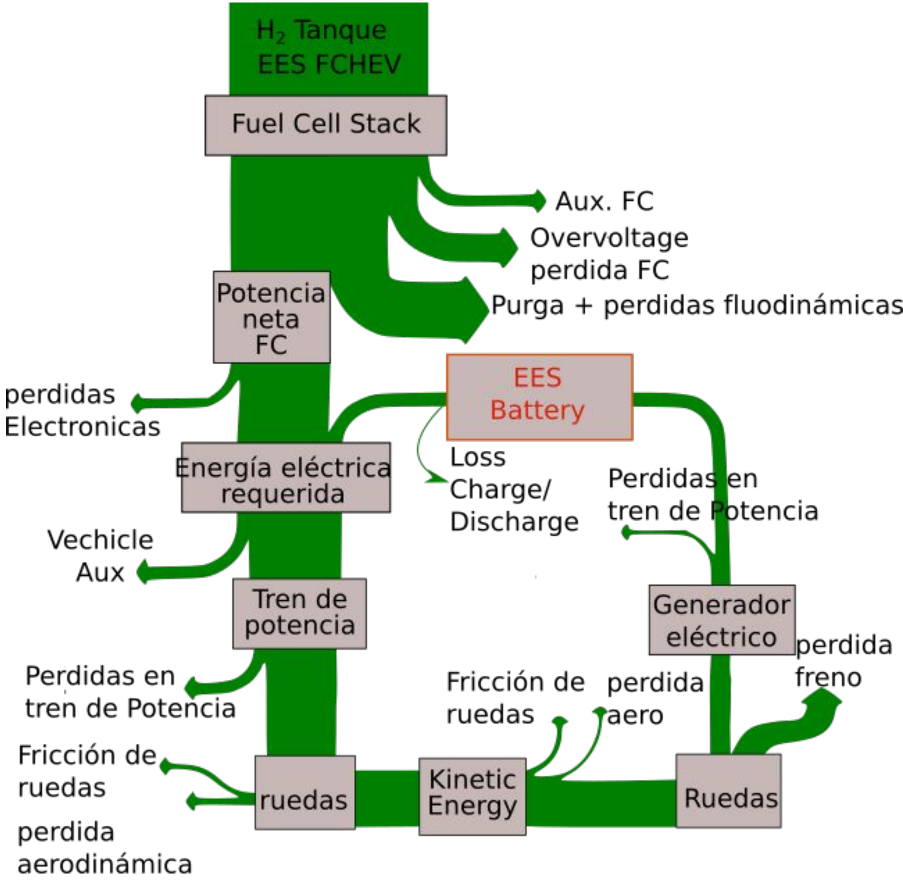
TTW - ICE & HEV buses



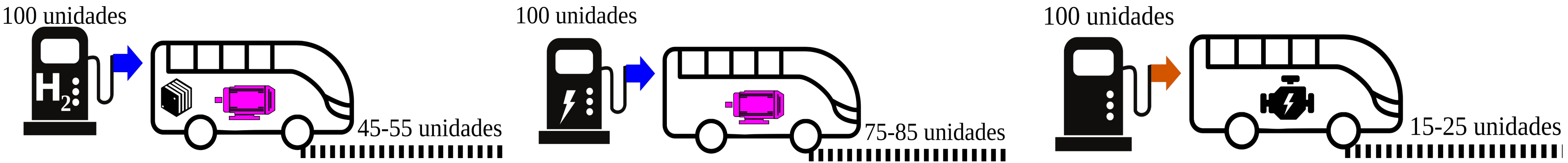


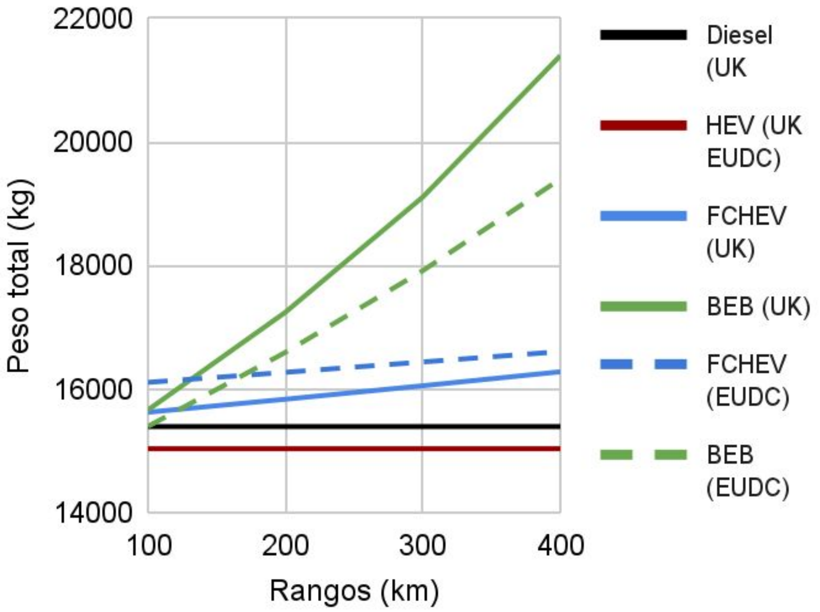
TTW -BEV & FCEV buses

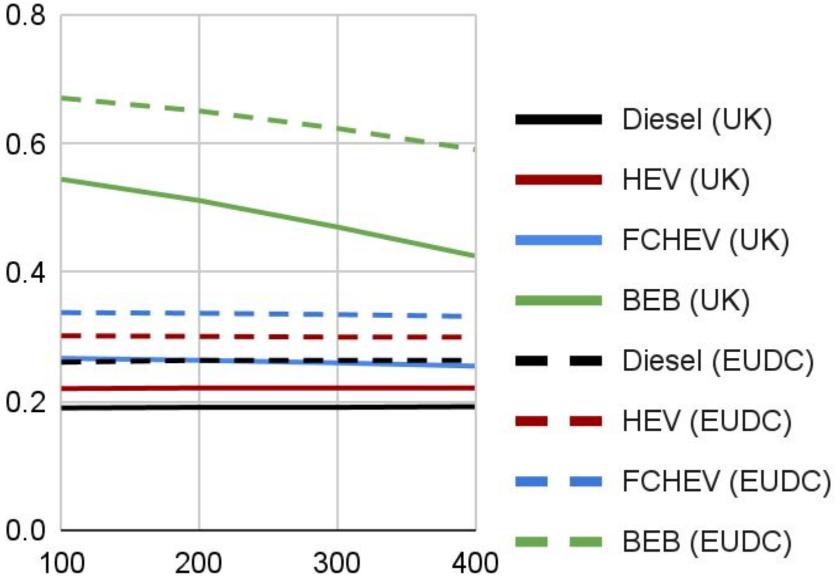




Del tanque a la rueda

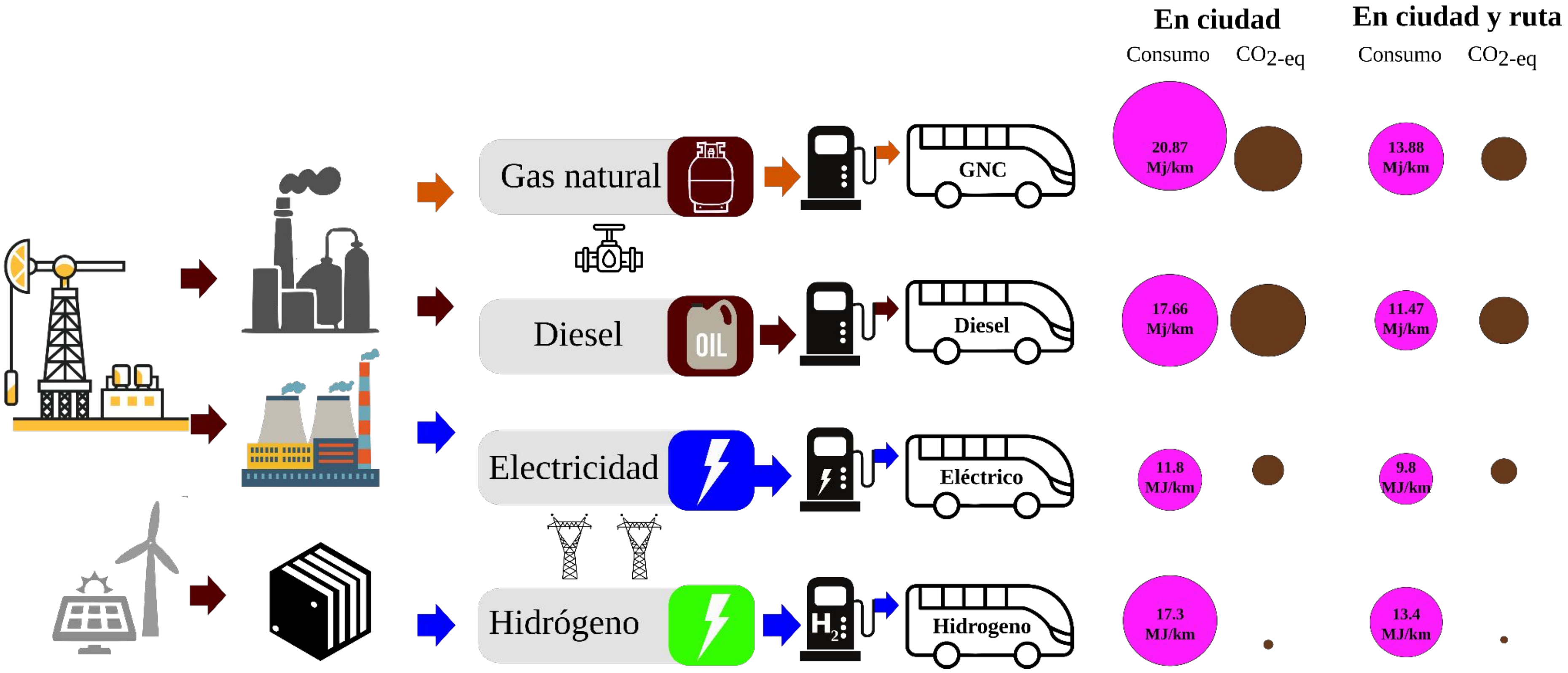






Consumos y emisiones WTW - datos 2019

200km

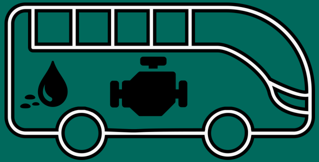


Transporte de pasajeros

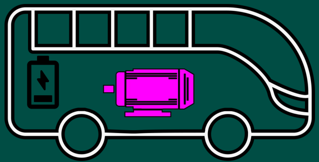
AMBA:
- 13 millones de habitantes
- 17000 colectivos urbanos
- 60% de cantidad de viajes del total del país
- 800 millones de km
- 47000 km por año x unidad

Brennan, P. (2013). El transporte urbano de pasajeros por ómnibus de buenos aires. 32. http://www.camarco.org.ar/File/GetPublicFile?id=491

BUS diesel:
- Total estimado país: 28000
- Diesel (euro VI) ⟶ 15.4 MJ/km
- Diesel total: 184 MWh x año x unidad
- País total: 184 * 28000
  5152 GWh o 430 GWh x mes



BUSES eléctrico total país:
- Relación energía **BEV/ICE 2.56**
- BUS-e total: 5152 GWh/2.56 x año
- 2000 GWh x año



Tasa de ocupación de vehículos de 1,45 pasajeros por automóvil

	Cantidad viajes diarios	Porcentaje
AMBA	19767983	60,07 %
Córdoba	2705310	8,22 %
Rosario	1854993	5,64 %
Santa Fe	1576366	4,79 %
Mendoza	1530430	4,65 %
Tucumán	1440045	4,38 %
Salta	1137418	3,46 %
Paraná	773039	2,35 %
Posadas	567620	1,72 %
Resistencia	501564	1,52 %
Neuquén	439956	1,34 %
Corrientes	421380	1,28 %
Cipolletti	190006	0,58 %
Total	32906110	

Transporte urbano e interurbano en la argentina. (2017).

Generación eléctrica Hidroeléctrica y Renovable

El Chocón y Arroyito sobre el río Limay. Tiene una capacidad de generación media anual de 3.600 GWh, que equivale aproximadamente al 5% de la generación del Sistema Argentino de Interconexión (SADI)

Generación eléctrica Renovable 2020

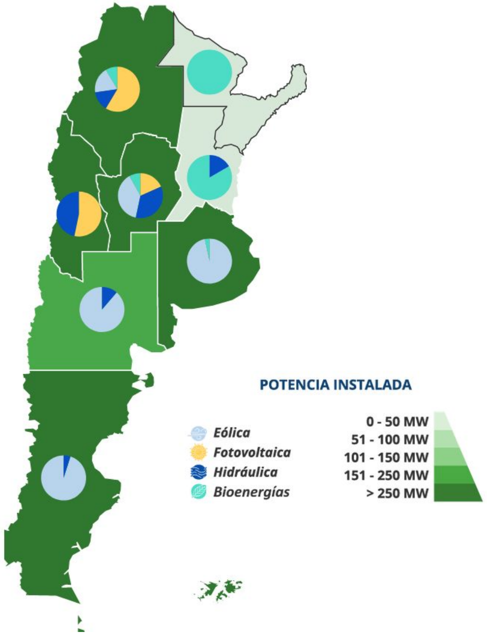
12.000 GWh es el anual renovable del país en 2020

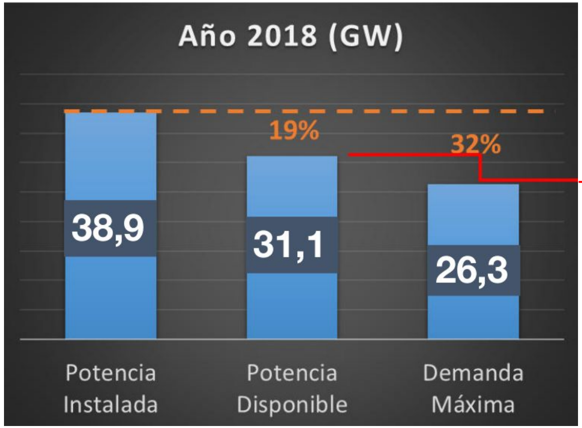
2020 hubo 4.926 GWh más que en 2019

63% interanual en la generación de renovables. En la composición de la matriz eléctrica se pasó de casi 6% a casi 9.5%

Potencia eléctrica instalada

Región	Eólica (MW)	Fotovoltaica (MW)	Hidráulica (MW)	Bioenergías (MW)	Total (MW)
NOA	158	493	119	72	842
NEA	0	0	0	64	64
CUY	0	205	180	0	385
CEN	128	61	116	27	332
LIT	0	0	2	10	12
COM	253	0	32	0	285
PAT	910	0	47	0	957
BAS + GBA	934	0	0	33	967
Total	**2383**	**759**	**496**	**206**	**3844**





4800 MW

Potencia cargador: 450kW
Flota hipotética: 10000
FS 100% -> 4500 MW
FS 50% -> 2250 MW

MeLICA

MOTO ELÉCTRICA
LITIO CATAMARCA

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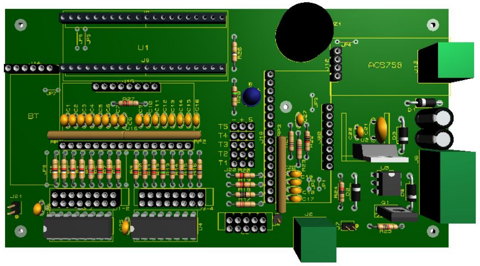
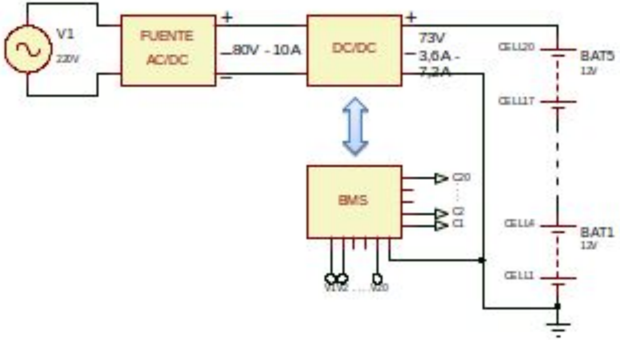
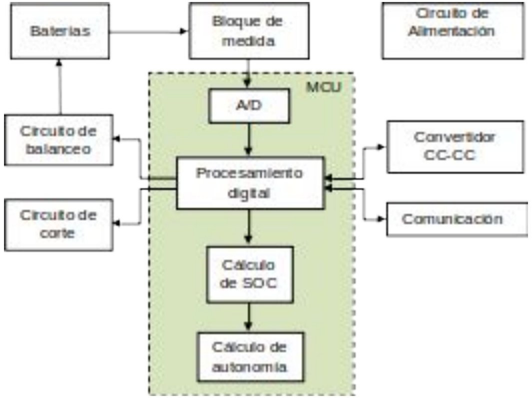
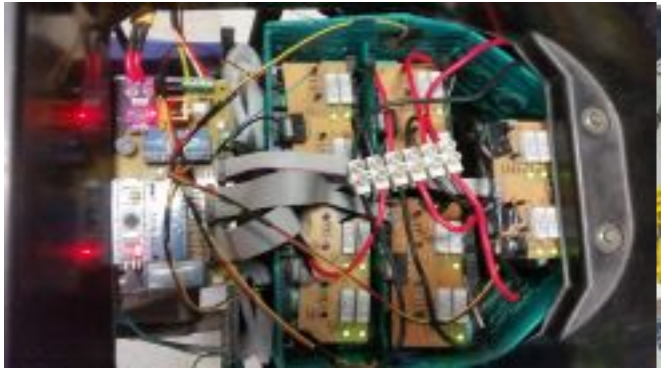
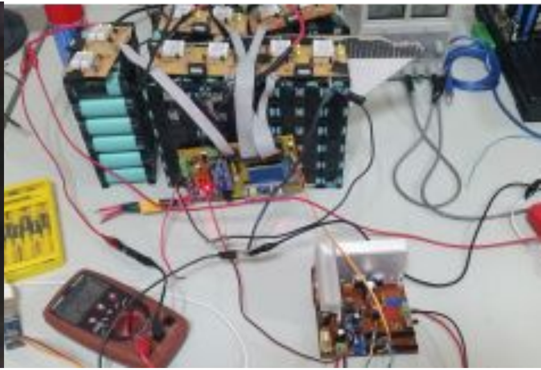
Desarrollo del BMS y cargador



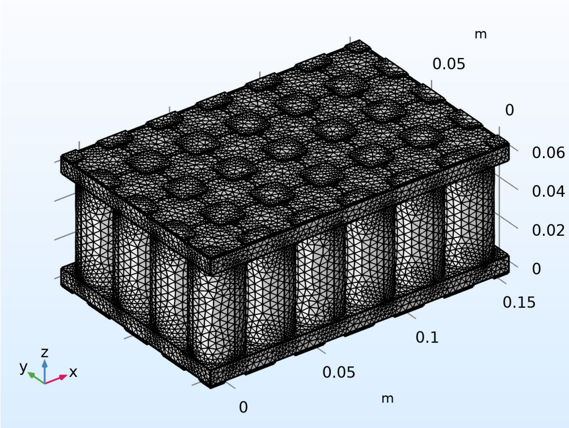


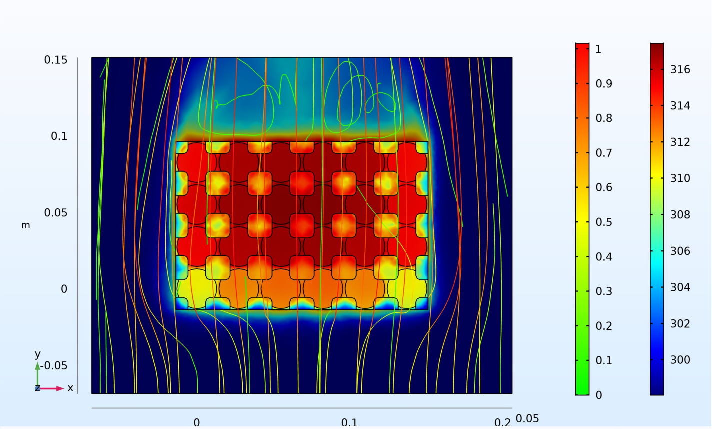


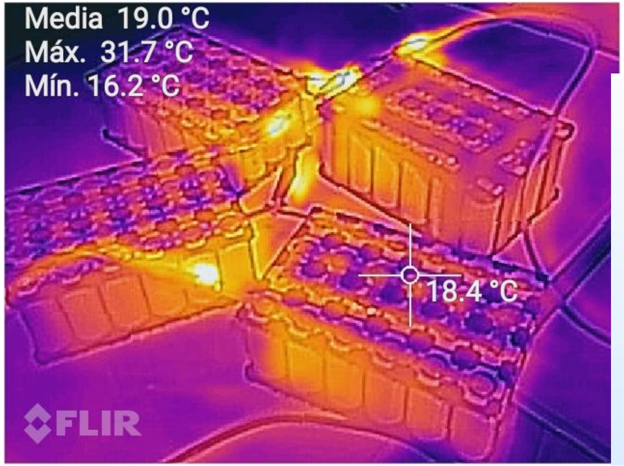


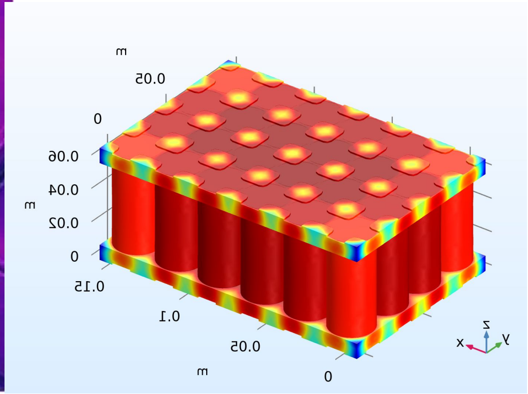


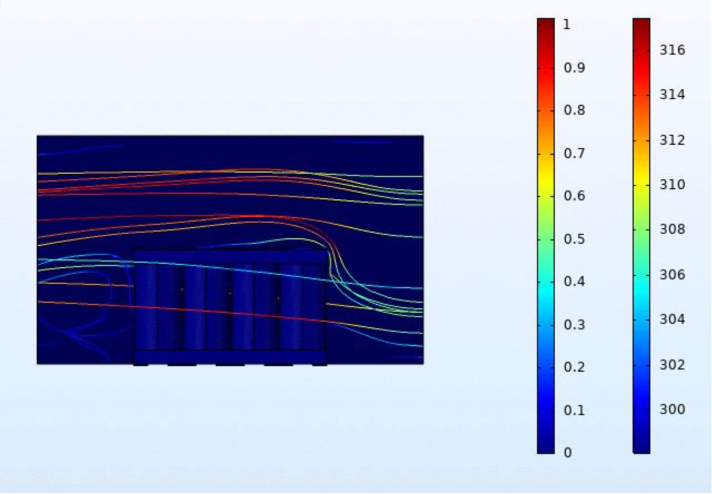
Análisis térmico de paquetes







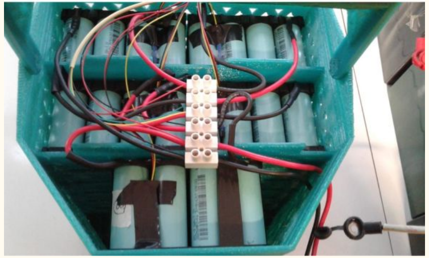




VENTAJAS DE LA BATERÍA DE LITIO

Los beneficios de pasar a un sistema eléctrico convierte a MeLICA en una moto más silenciosa, que no produce emisiones por combustión interna y su motor requiere menor mantenimiento que motores convencionales

Análisis Económico



La vida útil del paquete de baterías es de 2000 ciclos (5,5 años), equivale a 120000 km.

Consumo promedio de MCI 50km/l
$ 0.8 por litro
Para recorrer 120000 km->2400 l
Por lo tanto sería $1920

Autonomía de la moto MELICA = 60 km
Total energía de batería=1200Wh
Consumo combustible = 0.2kWh/km
Total pack+valija=U$D400

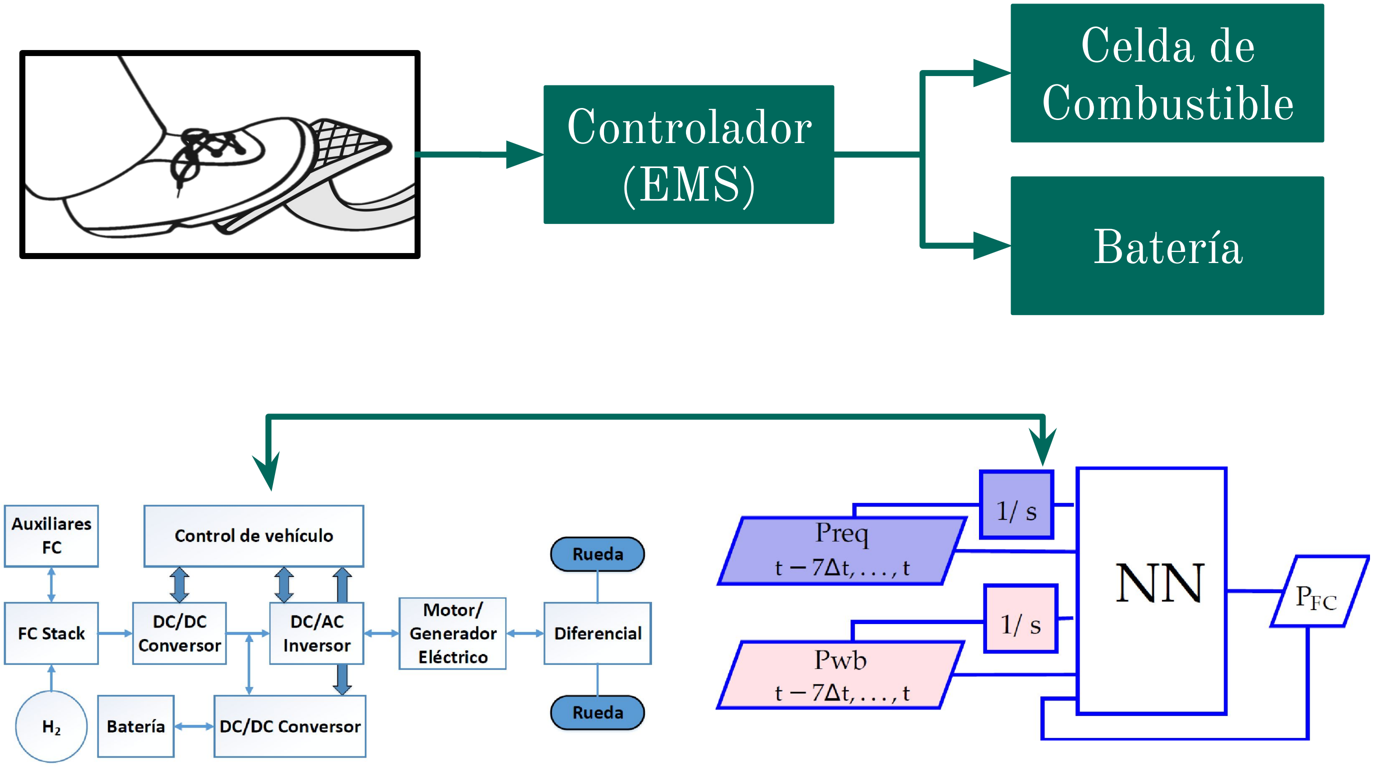
Costo electricidad (kWh) residencial en Argentina:
Córdoba =0.0722 $/kWh
Catamarca=0.0477 $/kWh
CABA = 0.0457 $/kWh

Si a esto le sumamos el costo del paquete sería
En Córdoba $1732 (el) y 2132.8 (con Bat)
En Catamarca $1544 (el) y 1144 (con Bat)
En CABA $ 1496 (el) y 1096 (con Bat)

Consumo diario de domiciliario promedio en Argentina 150 kWh por mes
La carga de la moto representa entre un 10% y un 20% del consumo total del hogar (suponiendo que se carga todos los días la moto)

Optimización manejo de la energía en un vehículo híbrido

Lograr un controlador de aplicación en tiempo real que sin conocer a priori el ciclo que permita obtener ahorros en el manejo de la energía buscado minimizar el consumo de hidrógeno sujeto a condiciones como ser mantener el mismo estado de descarga inicial y final de la batería.



¡MUCHAS GRACIAS!

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CAVEA

CAMARA ARGENTINA DE VEHICULOS ELECTRICOS ALTERNATIVOS Y AUTOPARTES