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ALTRAN

Electric Technologies applied to Racing Vehicles

Introduction to Quimera

Business Model: Partnership & Cluster Model

Main Technical Partner: Altran

Business Units: Consultancy + R&D + Joint Ventures

Geographic Influence

Quimera Responsible Racing (QRR)

Objectives

Partners

Strategy

Projects

AEGT Project: Technological Challenges

Other Technologies: Synthetic Fuel & IFR Automotive

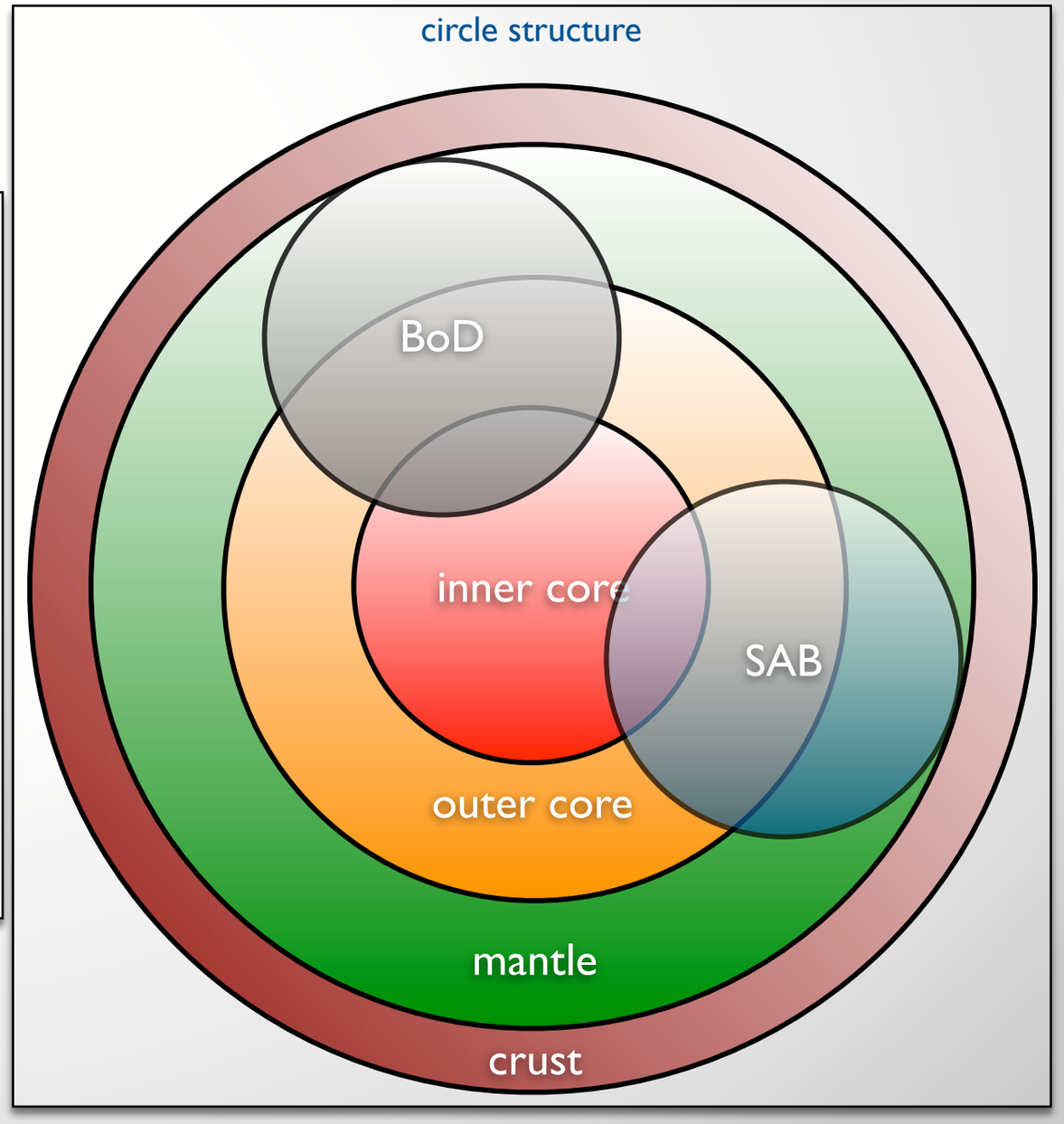
SmartLabONE Project: Terramar Racetrack

Quimera's Business Model

"A model of empowerment, efficiency and co-operation"

team table

level	involved people	relation type/involvement
Inner Core	16 pax	direct/full time
Outer Core	82 pax	direct/full or part time
Mantle	200+ pax	direct or indirect/ part time
Crust	N pax	indirect/part time
Strategic Advisory Board (SAB)	21 pax	direct/part time
Board of Directors (BoD)	9 pax	direct/full or part time



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Altran Group

- **An international group**
  Altran operates in some twenty countries throughout Europe, Asia and the Americas

- **A strategic Partner**
  Altran offers its customers global project support while guaranteeing a consistent level of service

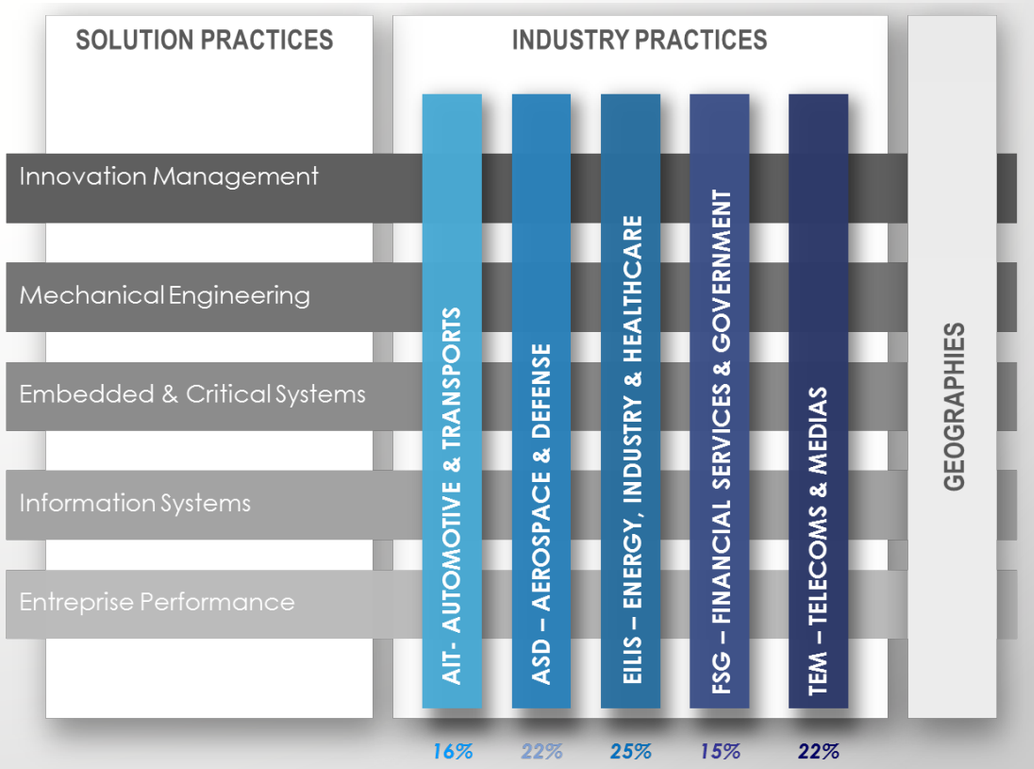
- **A local dimension**
  Altran keeps a local dimension while offering a specific support through geographical management

€ 1 420 m
REVENUES in 2011

49 %
REVENUES outside France in 2011

17 261
EMPLOYEES in 2011

20+
COUNTRIES



Electric Technologies applied to Racing Vehicles

1.c. Business Units: Consulting + R&D + Joint Ventures

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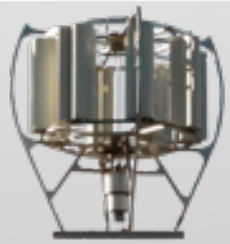
Quimera Holding

CLEAN MOBILITY



CLEAN ENERGY

QUIMERA

NEW BUSINESS DEVELOPMENT

QUIMERA SUSTAINABILITY SOLUTIONS (QSS)	Q MM Quimera Mobility Management	**Consulting Project development Project deployment**	Q EE Quimera Energy Efficiency	**Project management fees**
QUIMERA R&D AND IP MANAGEMENT (QRD)		**R&D activities carried out with Cluster Members (co-owned) or by Quimera's International proprietary research (100% ownership)**		**IP sales & licensing**
QUIMERA JOINT VENTURES (QJV)	Q RR Quimera Responsible Racing	**Development of spin-off's companies focused on the mobility & energy arena applying specific business models**		**Fees Dividends from spin-offs**

1.d. Geographic influence

Introduction to Quimera

- Business Model: Partnership & Cluster Model
- Main Technical Partner: Altran
- Business Units: Consultancy + R&D + Joint Ventures
- Geographic Influence

Quimera Responsible Racing (QRR)

- Objectives
- Partners
- Strategy
- Projects
- AEGT Project: Technological Challenges
- Other Technologies: Syntetic Fuel & IFR Automotive
- SmartLabONE Project: Terramar Racetrack

Pushing clean technologies to the limit in order to:

- Increase its customer and manufacturer's awareness
- Facilitate its transition to mass market

clean technologies
sustainable solutions
Living Labs
mass market
From race track to road legal
Smart Cities

AEGT: All Electric GT

From Competition

Engine solutions, Packaging solutions, BMS & EMCU...

Electric motorbike

Electric truck

to Urban mobility.

Chassis solutions, Design solutions, City Labs...

- **Leading the next generation of sustainable motor sport, a global non-fossil fuel based championship, which will take place by the end of 2013.**

- **QRR is a Joint Venture between the company Quimera, the International Motor Sport Association (IMSA) and the American Le Mans Series (ALMS).**

- **This partnership is expected to develop further by empowering R&D activities with both new and existing technologies, therefore emphasizing motor sport's essential role as a test bed for the automotive sector, technology transfer and other key potential applications.**

2.c. Projects

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2c. The Quimera-TTXGP Partnership

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“The Quimera-TTXGP Partnership: the epitome of mutual empowerment”

Electric Technologies applied to Racing Vehicles

2c. All Grand Formula project

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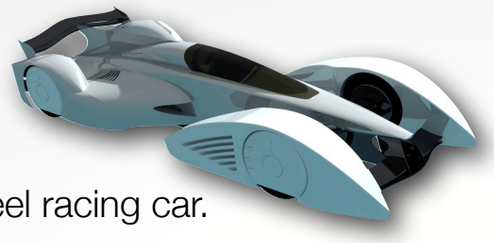
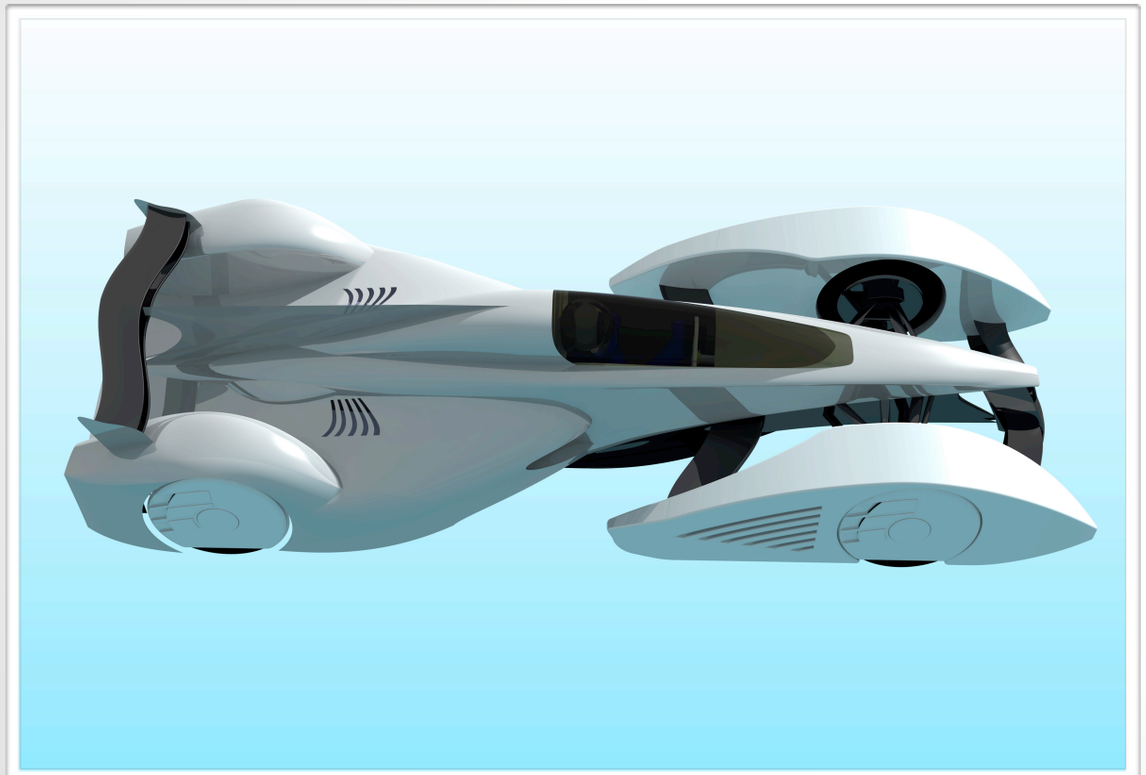
AEGF - All Electric Gran Formula

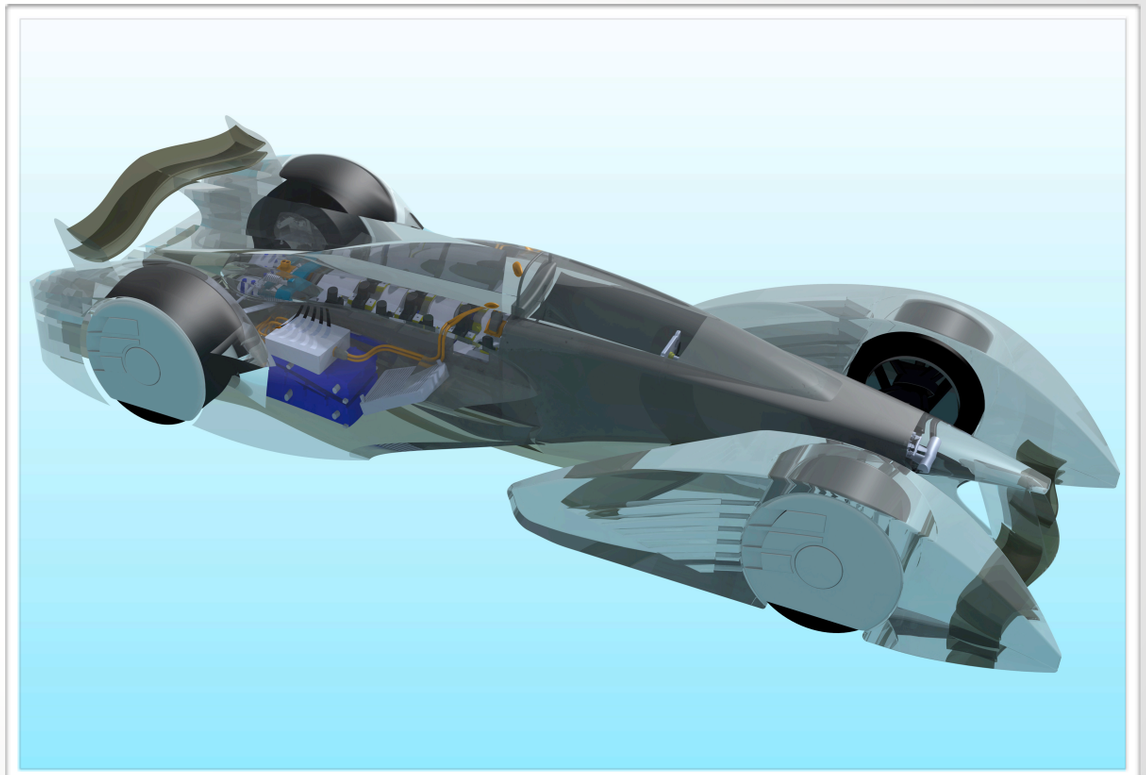


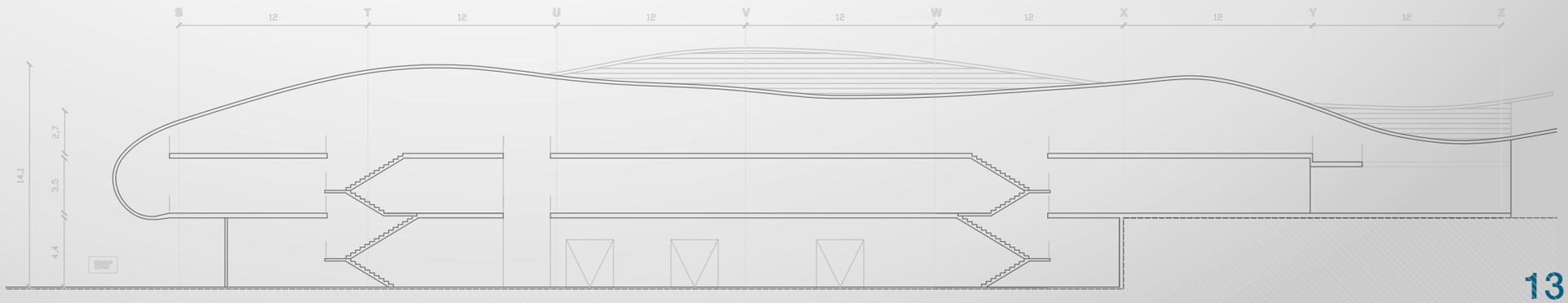
Finished design and engineering.

This will be the First Ever F1 type open wheel racing car.

First prototype to be manufactured



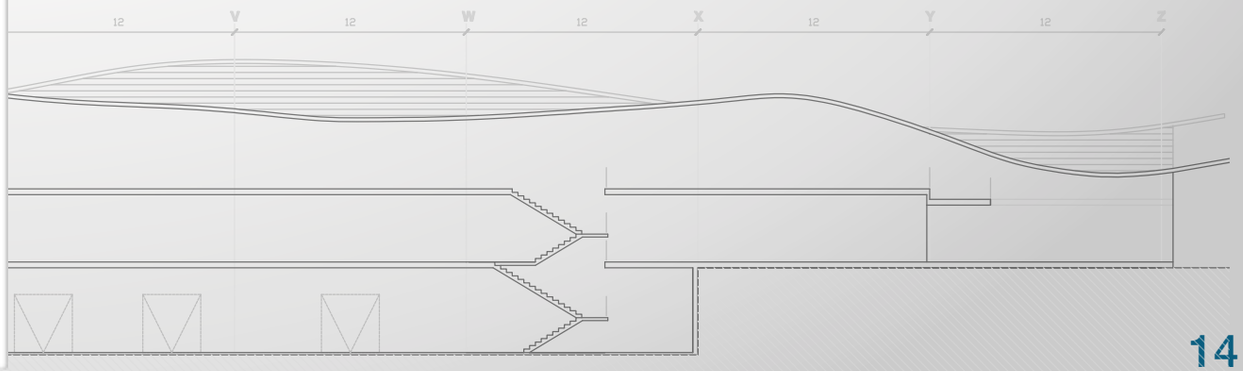




AEDC - All Electric Drift Car

First prototype completed

Evolution II to be developed



POWERTRAIN ELÉCTRICO

Integración motores eléctricos

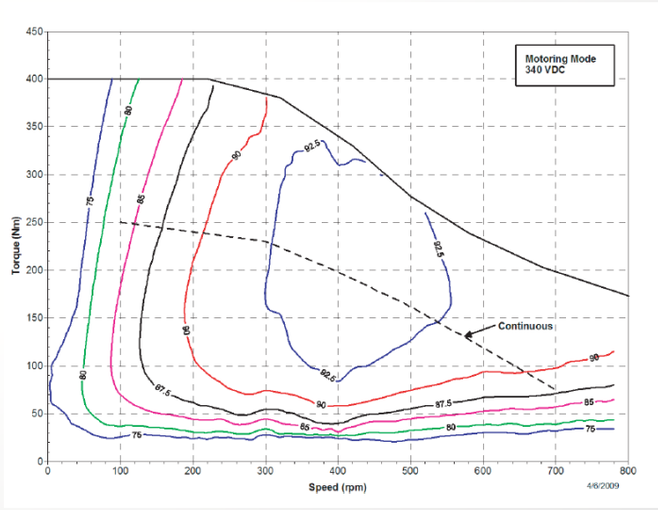
ALMACENAMIENTO ENERGÍA

Baterías

Los motores eléctricos son sistemas de tracción flexibles y eficientes para vehículos de competición

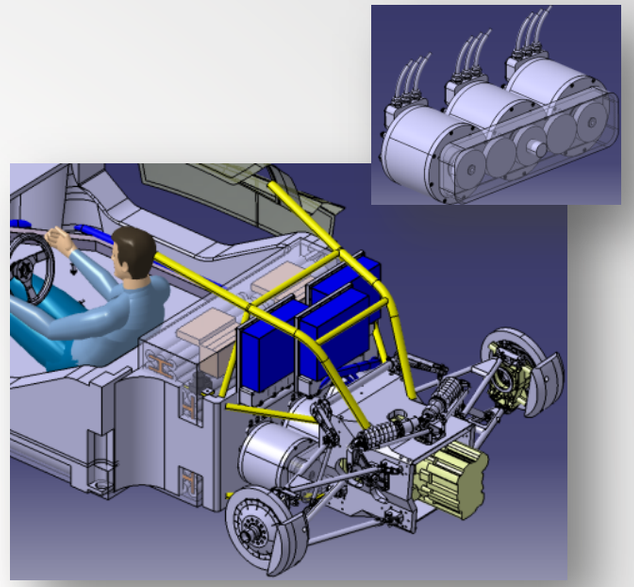
Tecnología

Motores de imanes permanentes (PMSM) acompañados por un "controller" que gestiona el par/régimen del motor.



Limitaciones y retos

- ✓ Gestión térmica: diferencia entre máximo par "pico" y "continuo"
- ✓ Integración en altas potencias (motores limitados a 150-200 kW)

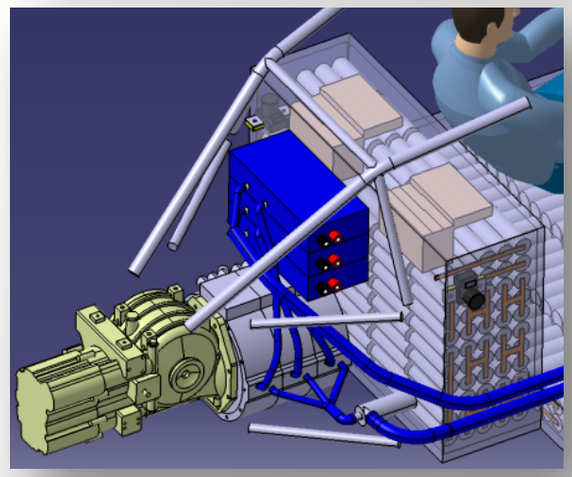


Para altas prestaciones es necesario integrar 2 o más motores

➔ AEGT: 3 motores de 170 kW cada uno

Los motores radiales permiten trabajar a más altas revoluciones, pero los axiales son más fáciles de acoplar.

AEGT (radiales) → AEGT Evo2 (axiales)



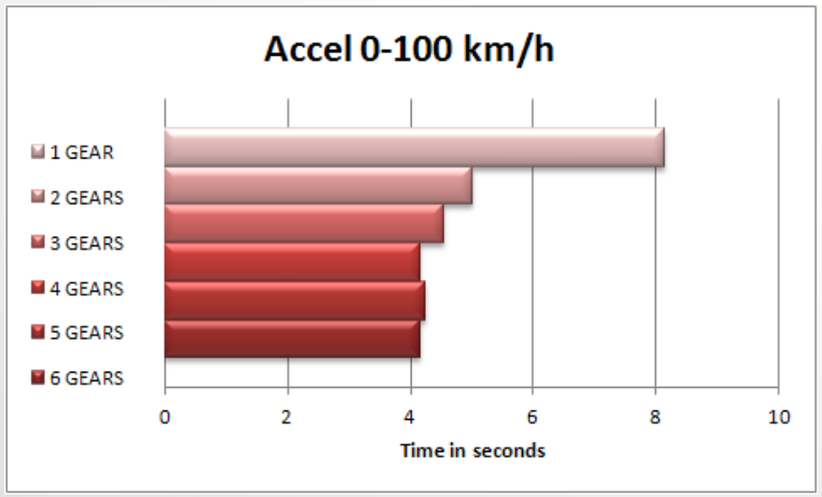
Los motores en rueda son una buena alternativa para el futuro pero su madurez tecnológica es aún baja para este nivel de potencia

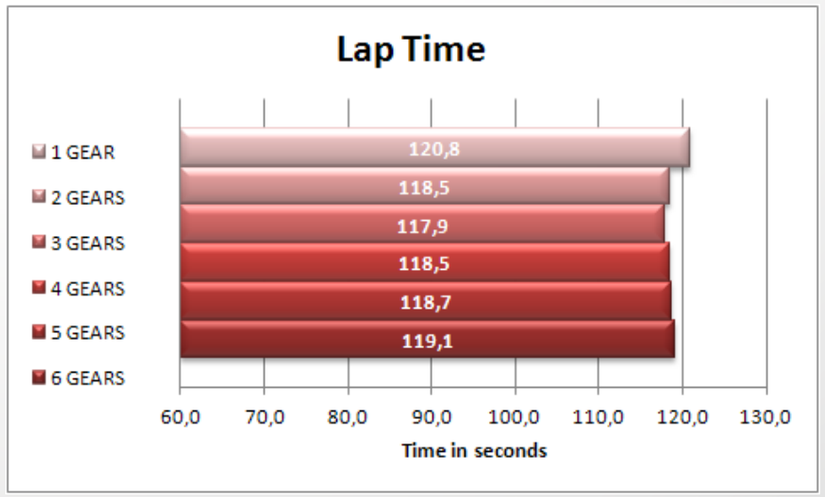
¿Es necesario una caja de cambios?

El AEGT incorpora una caja de cambios de 6 marchas. ¿Porqué?

- ✓ **Compromiso Aceleración / Vmax :** 2 o más marchas son necesarias para mantener un buen compromiso entre velocidad máxima y aceleración!
- ✓ **Gestión del par:** para desarrollar potencia (500 kW) sin desarrollar un par excesivo (limitaciones transmisión) es necesario operar en la zona de alto régimen del motor.
- ✓ **Sensaciones del piloto:** requisito del cliente

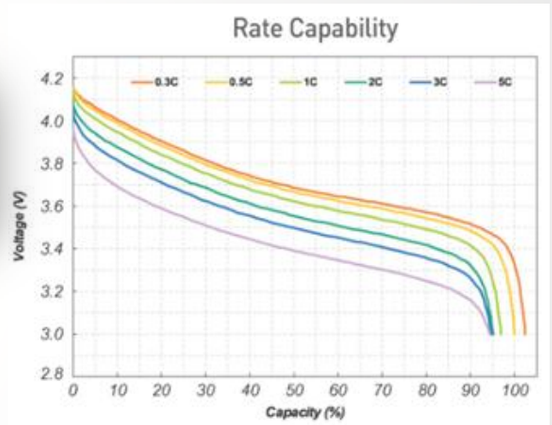
Estudio de prestaciones AEGT Evo2





Almacenamiento de energía: principal limitación de los vehículos eléctricos de competición.

La tecnología de las celdas ha mejorado, pero aún es necesario un salto tecnológico!



Tecnología

Celdas de Li-ión / Li – polímero

Energía específica: 140-170 Wh/kg

AEGT: 50 kWh / 350 kg de baterías para 15-20 min de autonomía!

Limitaciones y retos

- ✓ Energía y Potencia de las baterías vs Peso
- ✓ Integración del pack de baterías (volumen & seguridad)
- ✓ Refrigeración de las celdas

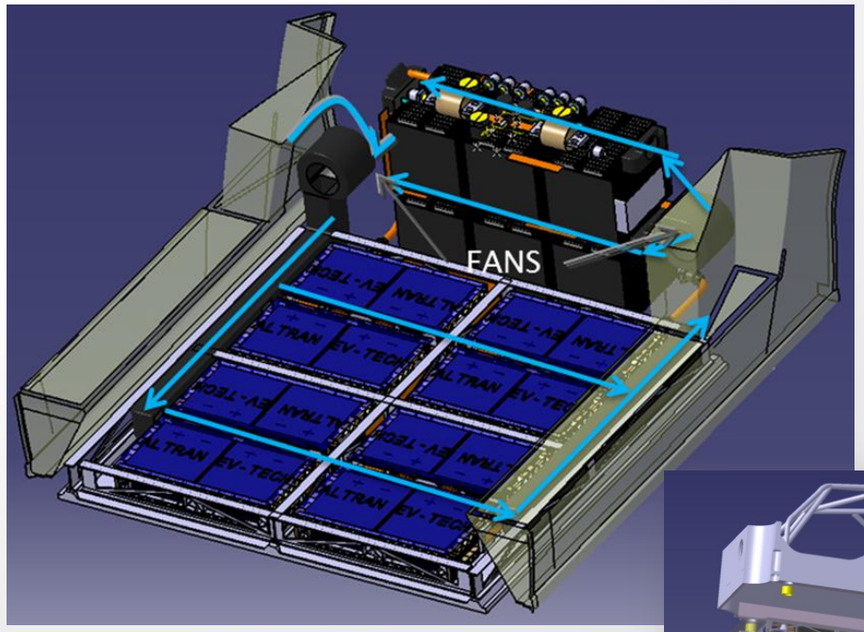
AEGT:

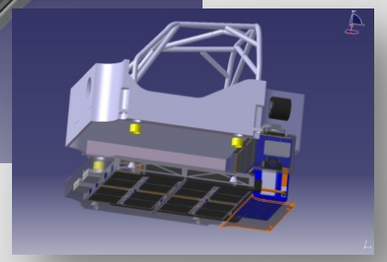
Pack de baterías localizado en los laterales del vehículo y refrigerado por aire no forzado (380V)

AEGT Evo2:

Pack de baterías integrado en la zona de seguridad y refrigerado por aire forzado (640V)

AEGT





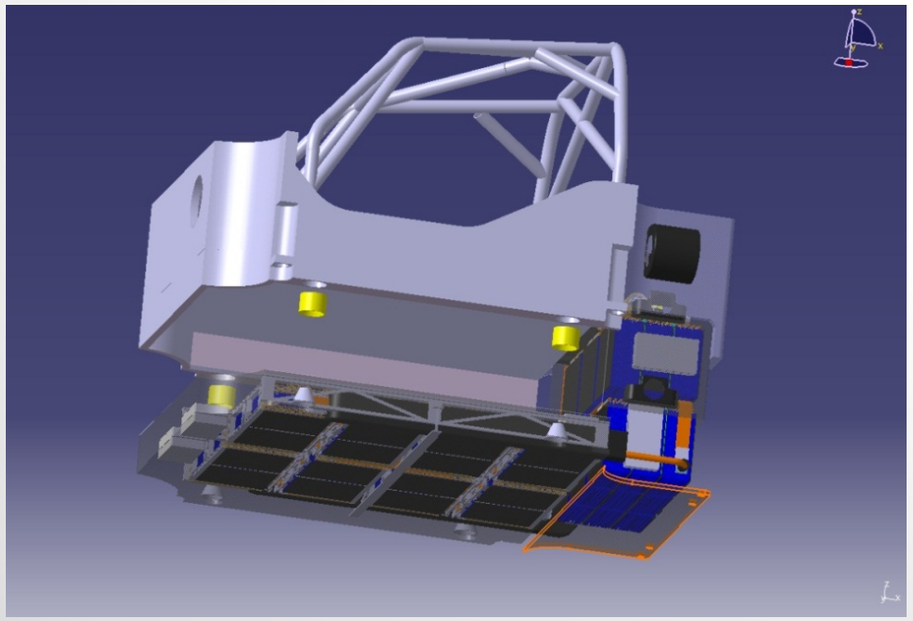
AEGT Evo2

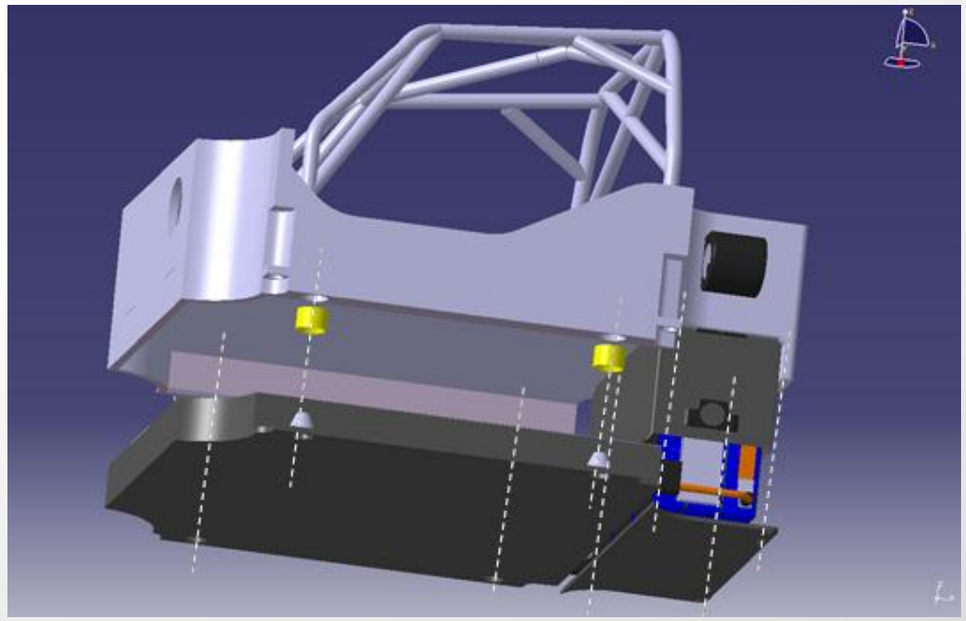
Un sistema de intercambio ha sido introducido en el diseño del AEGT Evo2, para permitir mejorar las características de la competición.

¿Por qué no usar sistemas de recarga rápida?

Para recargar el AEGT en 15 min (4C de intensidad), es necesario más de **200kW de potencia eléctrica**!!

Sistema de intercambio de baterías AEGT Evo2

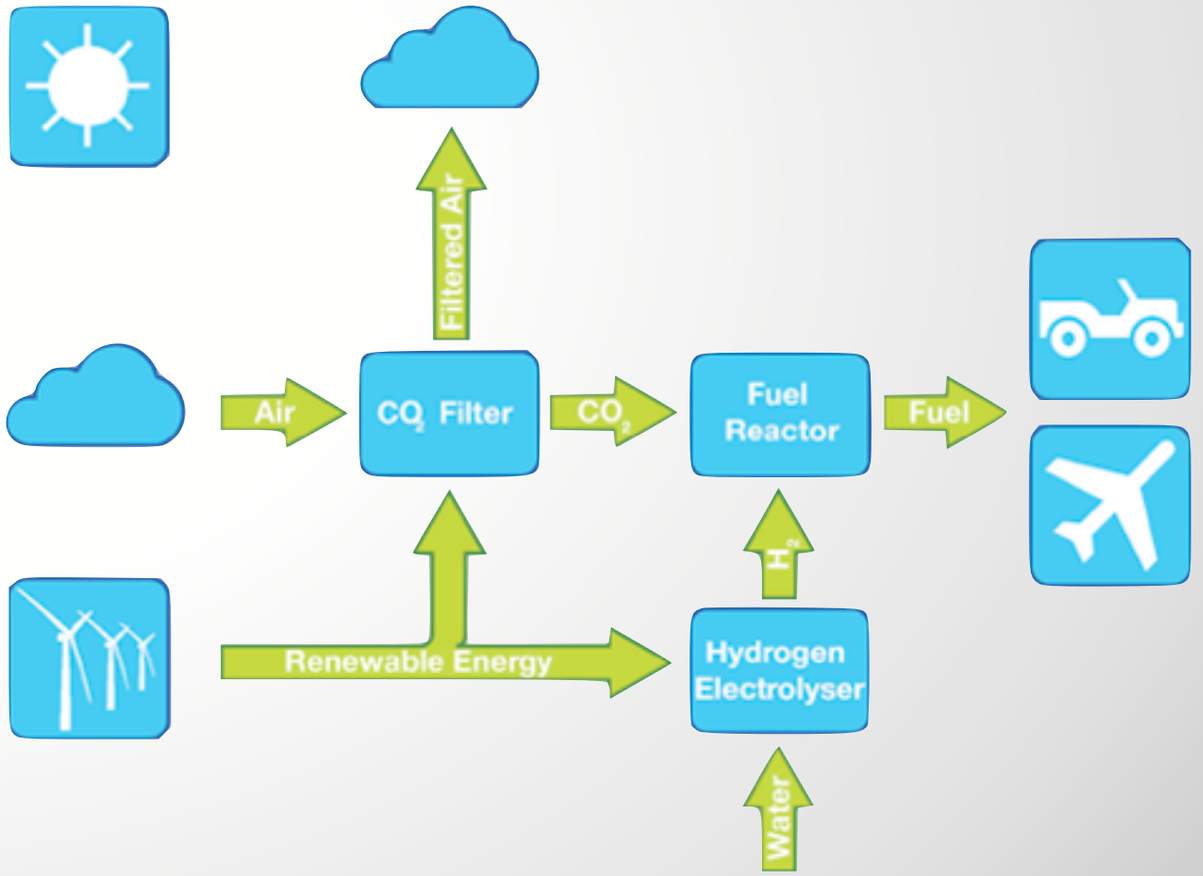




2.f. Other Technologies: Syntetic Fuel & IFR Automotive

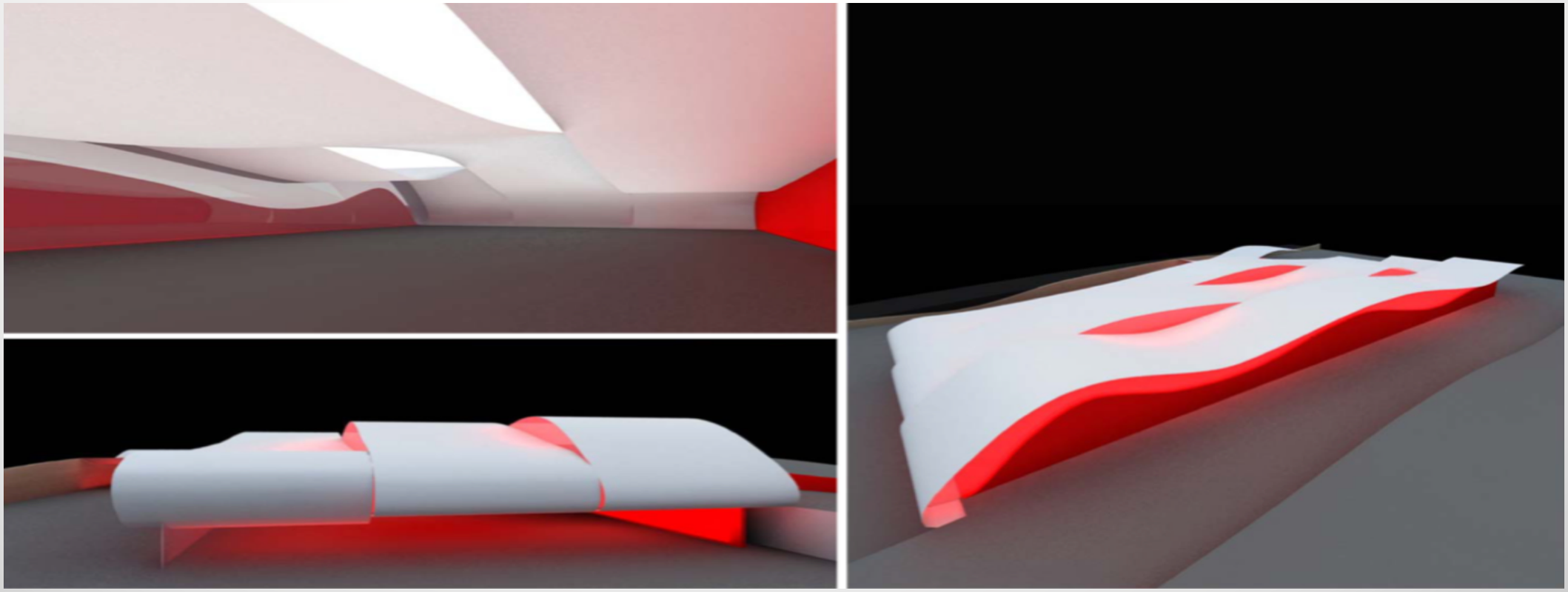
ifr automotive

AFS



SMART LAbONE

The creation of a new technology center to allow Qatar to be at the forefront
of sustainable mobility technologies, motorsport developments
and the innovation of other technological projects related to sustainability.



Smart LabONE activities

Research

- Research in Sustainable Mobility Solutions:
  - Solutions in all the required components (fuel cell, batteries, powertrains, electronics, fuel reactors, electric motors, hybrid systems, etc.)
  - Adhoc projects
  - Industrial and commercial applications
  - Tests and homologation (having a circuit nearby will provide very competitive advantage).

Communication

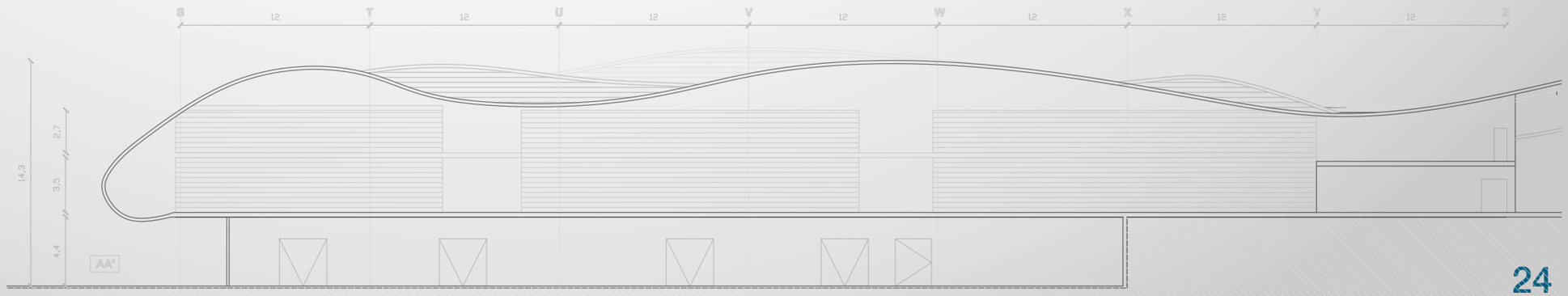
- Point of world wide reference for Sustainability Mobility Solutions
- Fairs and congress
- World wide presentations of Smart LabONE projects or from its partners
- Events organizations
- International press access

Engineering Development

- Commercialization of all potential solutions offered by the center
- Patents
- Engineering services
- Homologation

Motorsport

- Being the leading technological centre for Sustainable Mobility, a natural strategic development will be to showcase all these tecnologies at the highest possible performance.
- Motorsport is therefore, the most appropriate communication and visible platform to showcase the existing and future technologies and creating the most exciting environment.
- Objective: <u>To create and develop worldwide ‘Green Racing’</u>



2.g. SmartLabONE Project: Terramar Racetrack

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Thank you for your attention