Free Range or Battery Farming?

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plasan
INNOVATE. DELIVER. PROTECT.

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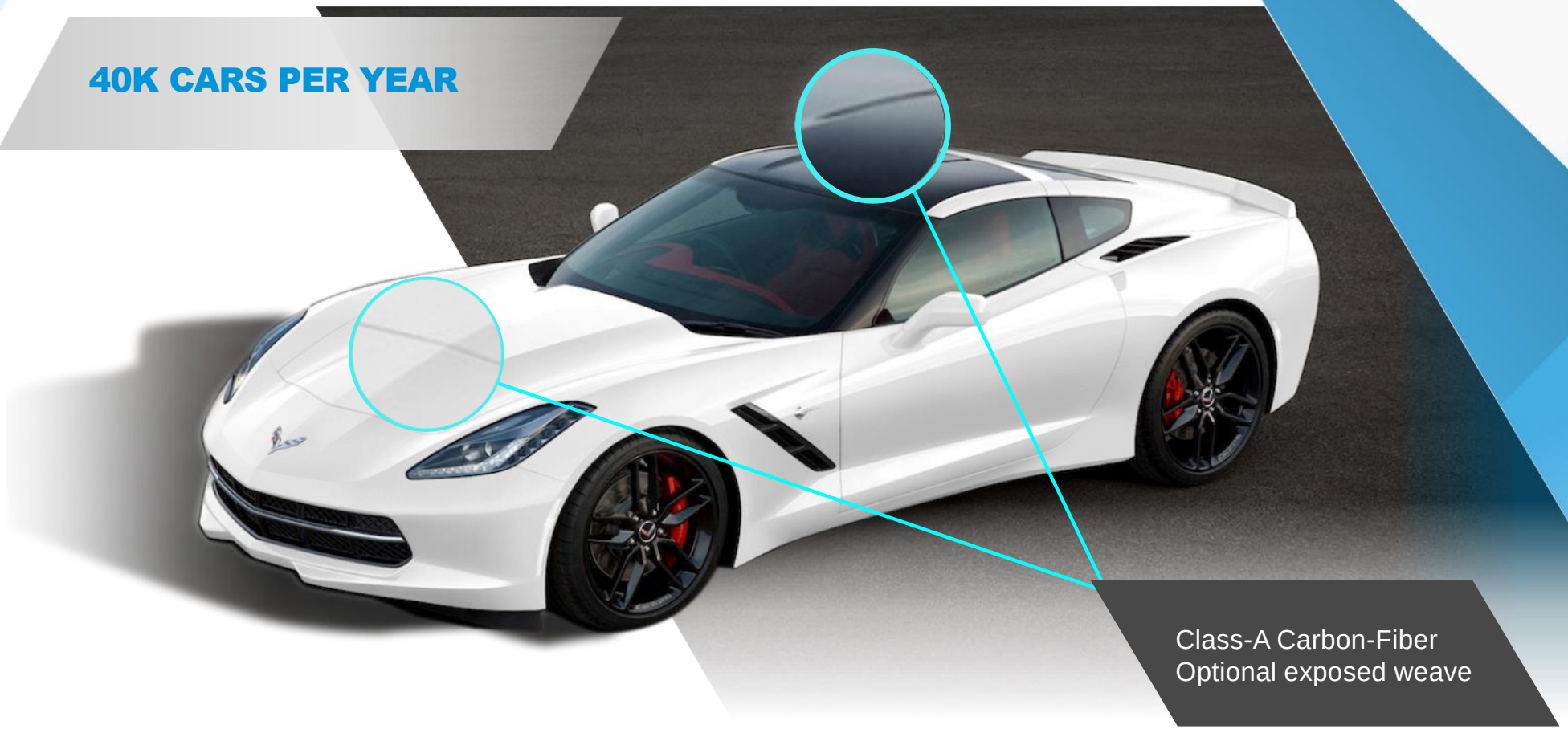
- New Composite Architecture Concept
- Summary

In-House Capabilities

Mass Production

40K CARS PER YEAR



Class-A Carbon-Fiber
Optional exposed weave

EVs, Power Management and Robotics

Free Range
is Better than
Battery Farming

Would you like the standard 50L fuel tank or to upgrade to the 100L tank for just €8000?

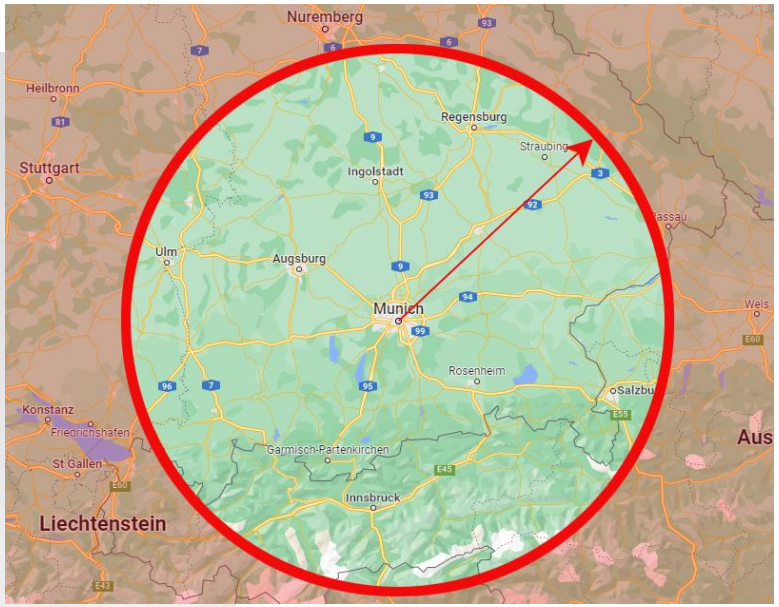
Photo: Senivpetro

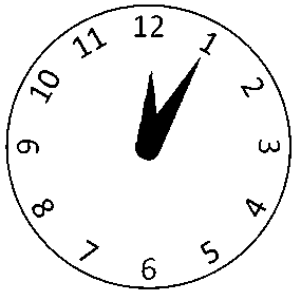
First Generation EVs Sold to an Immature Market

- Range, Range, Range – at any cost
- Easy solution is bigger batteries
- Adds weight and cost
- Competing in the premium sector
- Marketing distracts consumers with ludicrous acceleration times
- Bigger batteries are being mismarketed as if it's the equivalent of engine capacity
- Consumers only asking one question – How far will it go?
- Not asking how much electricity is it using per km travelled

What do Consumers Actually Care About?

- Range
- Charging time
- Purchase price
- Running costs





€

- 0-100km/h in 2.5s

Next Generation EVs Will Sell to a More Intelligent Market

- Greater awareness of how little range you need when you start every day with a “full tank”
- Widespread en route charging network will allow shorter range coupled with faster charging
- Energy crisis will make running costs a bigger priority and differentiator
- Greater competition will re-up importance of vehicle dynamics and other less tangibles
- Battery supply issues will advantage makers of cars that use fewer cells

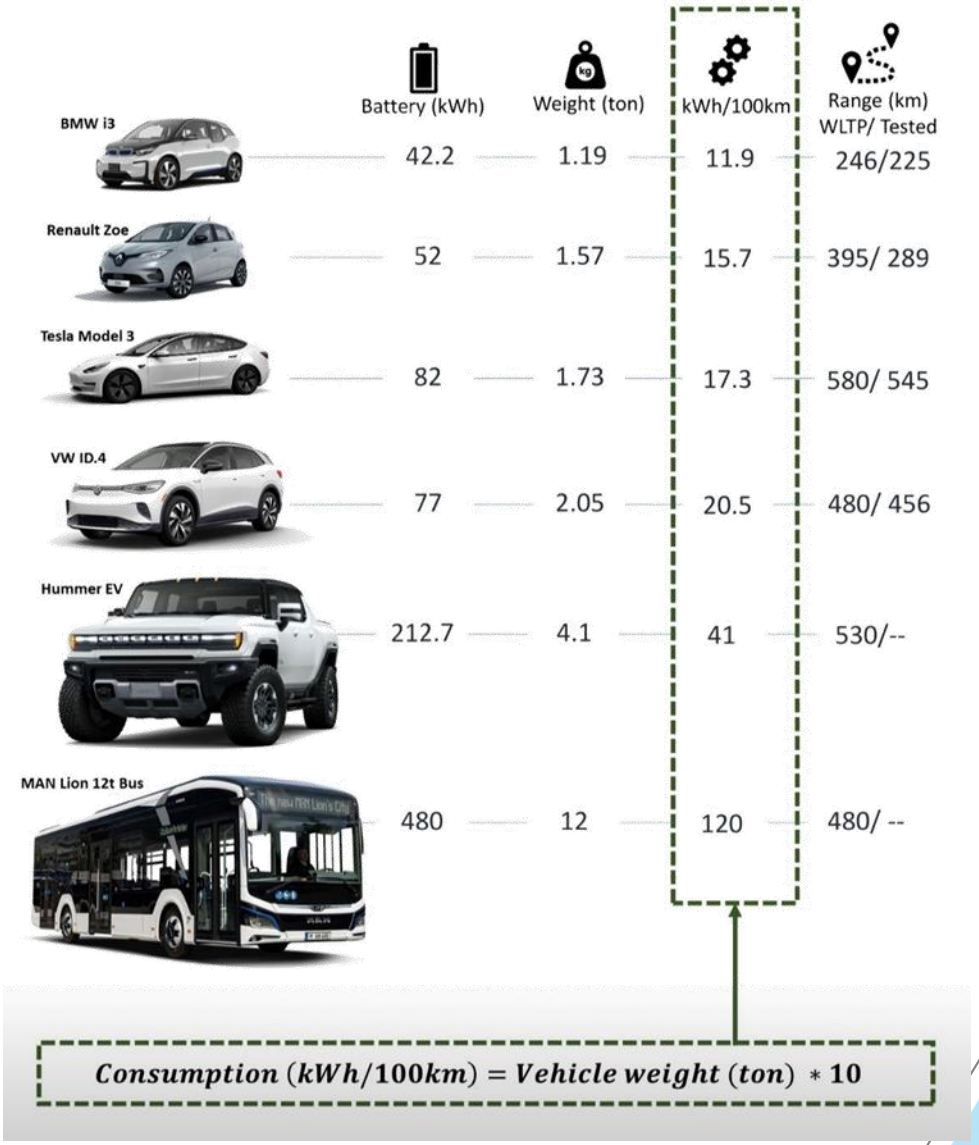
Relying on big batteries for range is not a sustainable solution

Use Less Energy to Drive Same Distance

- **Basic physics (Newton's 2nd law)**
- **If you want to use less energy to move something then make it lighter**
- **Yes, regenerative braking can recoup a proportion of the energy used accelerating but never all of it**
- **Not every uphill stretch of road is followed by a downhill stretch…**

"Adding power makes you faster on the straights; subtracting weight makes you faster everywhere"
Colin Chapman

"Adding batteries gives you range on the straights; subtracting weight makes you more efficient everywhere"
Nir Kahn



Cost:Weight Trade-off Including Battery Cost

- At around 10$/kg weight saving becomes cost-competitive with simply adding more batteries
- Brings additional benefits
  - Performance
  - Handling
  - Packaging
- A significant initial weight reduction from the body is necessary to reach a tipping point that allows battery reduction and a further downward spiral of weight loss

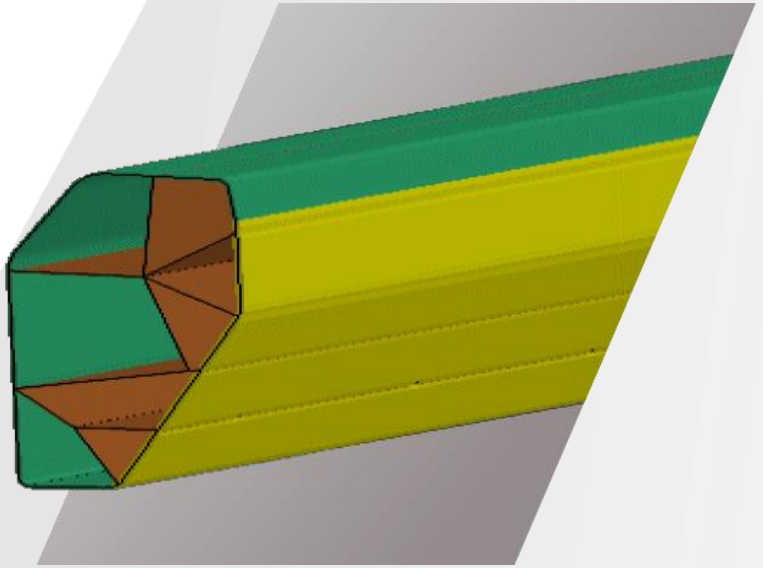
Additional cost for weight reduction can be offset by cheaper batteries

DESIGNING A CAR FOR COMPOSITES RATHER THAN SIMPLY FROM COMPOSITES

The First Proposal to Make Cars From Pressed Steel

Cost per Kg Saved

- Cost per kg saved is lower the harder the part is working
- Use less carbon-fiber
- Optimize its use with topological analysis
- Design parts for production with processes that are cost-effective for composites
- Design the car for manufacture with these processes



Pure Carbon Fiber, Standard Lay-up, Pultruded Beam

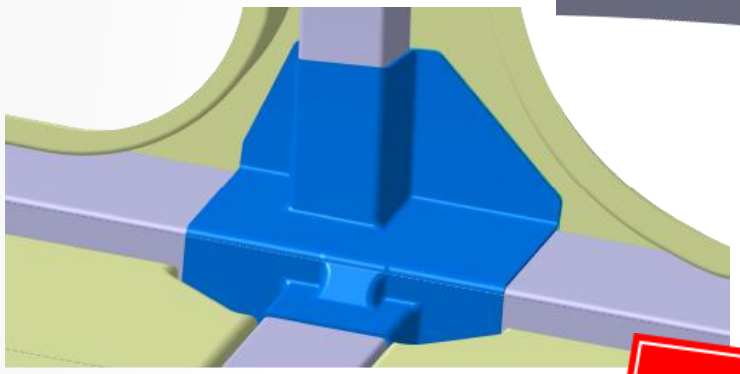
Hybrid Composite, Optimized Lay-up, Pultruded Beam

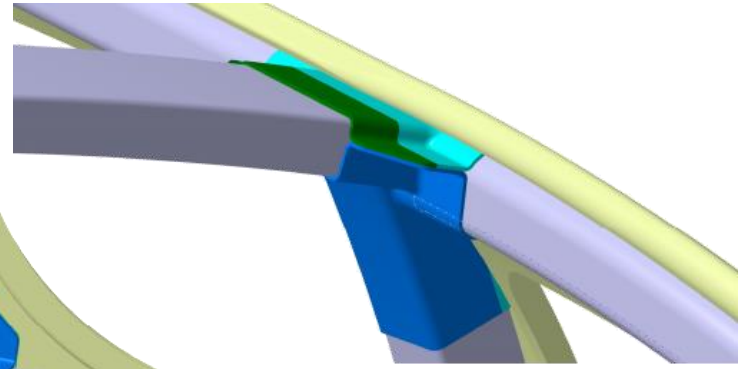
PLASAN PROPRIETARY

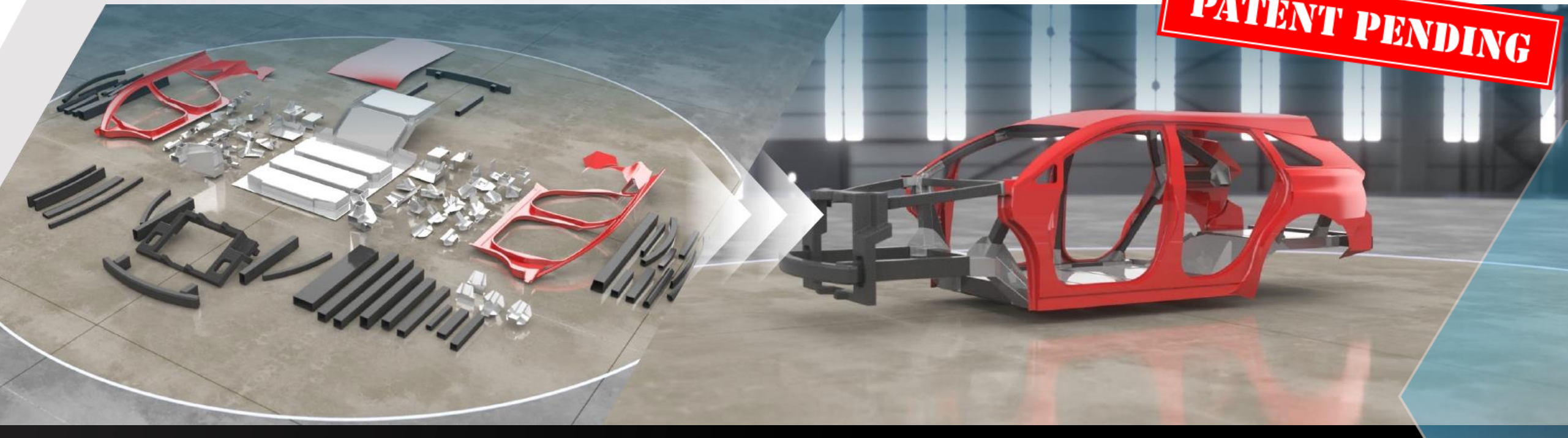
Composite-Intensive BIW for Mass Production

Minimal modification
to existing lines

Maintain layered approach
to BIW assembly







Layered Assembly Process

PATENT PENDING

Weight and Cost Study

- The Plasan BIW weighed 213.5kg, a saving of 169kg (44%) over the steel baseline and a saving of 46kg (18%) compared to a similar design in aluminum
- The Plasan BIW cost a premium of $1680 over the steel body and a premium of $836 compared to a similar design in aluminum
- Cost per kg saved compared to steel was 10$/kg
- Cost per kg saved compared to aluminum was 18$/kg

Compared to	Weight saved [kg]	Cost Delta [$]	$/kg saved
Standard Steel BIW	169	1680	10
Plasan design but all alu	46	836	18

Summary

- Next generation EVs are selling to a much more mature market
- It will value efficiency over big-battery range
- Weight reduction that is significant enough can allow smaller batteries
- Cost of weight reduction must account for this
- ~200kg at 10 $ per kg reduced is achievable in mass production

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