Today’s Presenter

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Agenda

01 Overview of EV Market

02 Insurance Product Offering

03 Focus on Pricing
Overview of EV Market
What are electric vehicles?
Categorising EVs leads to better understanding of new risks

ICE & Non-Plug-in Electric Vehicles

- **Petrol and Diesel Vehicles (ICE)**
- **Biofuels/Natural Gas Vehicles** (minor market share)
- **Hybrid Electric Vehicles (HEV)**
  No Plug-in: Combination of conventional ICE system with electric propulsion system (mild- or full-hybrid)

Plug-in Electric Vehicles (EV)

- **Battery Electric Vehicles (BEV)**
  100% electric powertrain with battery range up to 800km. Battery charged via plug-in to power source
- **Plug-in Hybrid Electric Vehicles (PHEV)**
  Combination of electric and ICE powertrain with up to 80 km electric range. Battery charged via plug-in to power source

To gain best data insights the highest granularity of powertrains is beneficial

*powertrain = system inside the vehicle, designed to propel the vehicle forward*
There are currently 4 main drivers for global E-Mobility

The focus is on governments, charging, battery costs and OEM’s

1. **Government**
   - Emission targets to force OEM’s to manufacture more EV’s and push Sales incl. strategies to ban ICE’s at a certain time
   - Create incentive schemes with one-time payments or tax benefits to push sales

2. **Battery**
   - Battery pack costs in EUR/kWh
     - 2018: 152
     - 2019: 139
     - 2020: 120
     - 2023: 85
     - 2030: 49

3. **Charging**
   - The more public charging stations the higher the EV Sales?
   - Super Charging points still rare good

4. **Car manufacturer (OEM)**
   - Not sufficient BEV models in the market? Chance for new market players
   - OEM’s plan to increase their EV model platform to serve all client needs – over 100% increase is expected in next 5 years
The charging demand is expected to grow at 36% CAGR throughout the following 8 years, reaching up to 86TWh in 2030 from the public and private sector.

The share of EVs sold vehicles in China tripled between 2020 and 2021 from 5.3% to 16% due to a supportive regulatory environment.
Evolution of the EV-market from our perspective

The 3 phases of EV adoption

**Phase 1: Exploration**
- Only very few EV models existing, often based on existing ICE-models,
- Government incentives have started,
- Little charging infrastructure in most areas,
- PHEVs are introduced as a stop-gap measure,
- Few clients consider EVs due to high prices, insufficient range, lifetime concerns, ...

**Phase 2: Ramp Up**
- Market leading OEM’s have appealing EV offerings,
- Government incentives bring down high EV prices,
- Charging infrastructure is becoming widely available,
- PHEVs are being phased out,
- Many clients consider EVs as a possible option (in the near future), range anxiety & lifetime concerns are alleviated by bold warranties from OEMs

**Phase 3: Mass Market**
- Most OEMs are transitioning to an EV-only portfolio,
- Government incentives phase out, bans/restrictions on ICEs are on the announced,
- Competitive prices for EVs & affordable models
- 2nd Hand market starts having some EVs
- For new purchases, EVs are becoming the “default” option, ICEs an exception

**Customer**
- Innovators, niche sectors
- Early adopters (private & corporate), some sectors
- Most customers and sectors
Insurance Product Design
Insurance for electric vehicles
How EVs fit in the motor insurance landscape

**Traditional**
TPL is unchanged

**Comprehensive**
- Battery
- Charging equipment
- Fire
- Electronic

**Additional**
**Assistance**
- Towing
- Out of charge

**Extras**
- Cyber attacks
- Software Updates (OTA)

**Marketing**
Options in the markets
- Add-ons
- Discount strategy
- Include in existing tariff – no opt-out

**Feasibility**
- EV sales landscape
- Assistance
- TPA network
- Experience in EV claims
The insurance process from an EV perspective
Challenges and focus areas for insurers along the value chain

<table>
<thead>
<tr>
<th>Product</th>
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<tbody>
<tr>
<td>- Market penetration of EVs is increasing steeply</td>
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<td>- Battery capacity decreases around 2% p.a.</td>
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<td>- Huge differences among brands</td>
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<th>Pricing</th>
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<tr>
<td>- Lack of claim history</td>
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<td>- The engine size cannot be used for ratemaking</td>
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<td>- Faster acceleration compared to ICE cars</td>
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<tr>
<th>Claims</th>
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<tbody>
<tr>
<td>- Other trends in severity and frequency than for ICES</td>
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<tr>
<td>- Large age bias in EV fleet as of today</td>
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<tr>
<td>- Sparsity of specialised workshop/EV know-how</td>
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<tr>
<th>Sales</th>
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<tr>
<td>- Important for external perception</td>
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<tr>
<td>- Experience among agents just building up</td>
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<td>- Potential to cross sell and shape future portfolio</td>
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Outlook: A limited type of EV Covers types with some local preferences and strong wording specificities

**Product**

- **TPL**
  - Mandatory TPL cover is very much the same as for ICE vehicles

- **Definitions how to insure**:
  - Battery (TBD: New Price / Time value / Residual value)
  - Charging equipment incl. wall box
  - Purely electrically caused fire
  - On-board electronic failures/short circuit

**Comprehensive**

**Check Feasibility on market level**

- **EV Model and OEM landscape** – now and within next years
- **Existing assistance landscape for EV**
  - Towing of EV/disposal costs
- **Existing TPA network & Know How @ repair shops**
  - Experience in EV claims e.g., rates per hour

**Pricing**

- **EV Model and OEM landscape** – now and within next years
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**Claims**

**Sales**

**EV specific additional policy coverage**

- **Services**
  - Assistance Services
    - Towing
    - Mobile Charging in case of empty battery or battery failure

- **Extras**
  - Cyber attacks
  - Software Updates (OTA)
  - Specialised garages

**Product Marketing**

**Options in the markets**

I. Add-on product with extra charge
II. Discounts of 10%-20% – low prices to get more EV volume
III. Include in existing tariff – no opt-out
The powertrain is influencing the fire risk
EVs show lower frequency but higher complexity

Studies converge into lower frequency…

- Fire per 100k sales

…but highlight more complexity to extinguish fire
- Electro-chemical fire
- Batteries are their own (large) source of energy
- Fire reignition up to 48 hours for days as batteries do not cool down
- Un-trained fire brigade

1 Source: US National Transportation Safety Board
Sales opportunities – food for thoughts
Outlook future EV sales channels and business models

Potential of cross selling adjacent products/providing extra service

1. Telematics
   - Driving Behaviour EV
   - Enrich existing offerings

2. Cyber
   - Connected Cars
   - Additional covers

3. Charging
   - Insure public charging stations
   - New Sales Channel

4. Battery
   - Extended Warranty
   - Refurbishment → 2nd Life → Recycling

EV Business Models

New opportunities
How to react from an insurance perspective
Our view on EV motor insurance needs and what we can offer

Continuous Improvement & Preparation for next phase(s) is key to success

Insurance needs at this stage

- **Create** EV “classical” Motor Product
- **Create** sustainable EV Pricing strategy
- **Define** EV Marketing/Sales approach
- **Prepare** Claims handling
- **Analyse own** EV Portfolio and match with others
- **Review** own Product & Pricing strategy
- **Screen** market for EV partnerships to grow
- **Refine** claims handling processes
- **Defend** Strong EV book
- **Grow** business from EV ecosystem (EW, …)
- **Optimize** residual value for EVs
Focus on Pricing
Risk segmentation regarding electric vehicles

Overarching goal: avoid anti-selection

**Approach**: designing an optimal commercial rating structure, catering for EV specificities

**Idea**: Electric vehicles can be used as separate rating variables in the GLM rating structure

<table>
<thead>
<tr>
<th>Base Coefficient</th>
<th>Coef1</th>
<th>Coef2</th>
<th>Coef3</th>
<th>Coef4</th>
<th>Coef5</th>
<th>...</th>
<th>TP MD Freq</th>
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Some **Challenges**:

- How to map new EV with existing ICE (similar models)? → Use of insurance association gradings
- How to convert kWh to engine capacity/power → Mapping tables / models re-calibration
- How to cater for limited exposure → External/other markets data and expert judgement

Through **monitoring** efforts of specific KPI's, this initial price can then be refined

Through **generating more claims data**, this approach can be extended i.e. to more granular makes/models
Some quantitative findings

- **Different trends** in frequency and severity, compared to ICEs.
- A deep dive into the structure (age, brand, etc.) is necessary to remove bias.
- **GLM effort** to identify marginal impact of powertrain on frequency/severity.
- Modelling effort performed on existing portfolio with sufficient exposure.

Powertrain impacts both MTPL and MOD covers, in different ways.

![Impact of powertrain on burning cost (based on GLM analysis)](chart.png)

- MTPL
  - Accidental Damage
  - Glass
  - Assistance
  - Other
- MOD

<table>
<thead>
<tr>
<th>BEV</th>
<th>Moderate increase</th>
<th>Light increase</th>
<th>No impact</th>
<th>Light decrease</th>
<th>Moderate decrease</th>
<th>Strong decrease</th>
</tr>
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<tbody>
<tr>
<td>PHEV</td>
<td></td>
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SAC 2022 03.10.2022
How to tackle different risks?
A changing risk requires a change in perspective

**Current Challenges**

- Lack of claim history
- Engine size unavailable for ratemaking
- Faster acceleration

**Possible Solutions**

- Vehicle allocation (RE_Wheel)
- Tracking the customer’s car change
Introducing EVA
Electric Vehicle Analytics

Collective MR Exposure
- **Risk Models** | MOD and MTPL models are used to extract the individual risk for specific vehicles
- **Risk Isolation** | Effects of standard variables (e.g., driver age) as well as geospatial effects (e.g., postcode) are isolated from the pure vehicle risk

### Vehicle Features
- **General**
- **Engine and Transition**
- **Dimensions and Weights**
- **Body and Chassis**
- **Performance**
- **Equipment**

### Vehicle Allocation
- **External Features** | Data Enrichment with more than 250 external vehicle features
- **Selection** | Around 50 features are selected and preprocessed to define similarity
- **FAMD** | Unsupervised learning approach makes use of PCA and MCA to reduce the dimensionality and define the vehicle allocation

Mapping of Client EV Proposition
- **Mapping** | Client data is mapped to our risk groups
- **Ranking** | EV list entries are ranked by their standardised riskiness

<table>
<thead>
<tr>
<th>Original</th>
<th>Mapping Key</th>
<th>Risk Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audi A6 PHEV A6 PHEV S Line Black Edition Plus Quattro 50 TFSI E 295BHP 4 DOOR Saloon Petrol Electric DSG ALL WHE</td>
<td>Audi_A6_299_PlugIn-Hybrid</td>
<td>2</td>
</tr>
<tr>
<td>Audi Q3 PHEV Q3 PHEV S Line 45 TFSI E 242BHP 5 Door SUV Coupe Petrol Electric DSG 2WD</td>
<td>Audi_Q3_245_PlugIn-Hybrid</td>
<td>5</td>
</tr>
<tr>
<td>BMW 3 Series PHEV 3 Series PHEV 330E M Sport 288BHP 5 Door Estate Petrol Electric Automatic Rear Wheel Drive</td>
<td>BMW_3er-Reihe_292_PlugIn-Hybrid</td>
<td>3</td>
</tr>
</tbody>
</table>

Data and figures for illustrative purpose only
Thank You

Singapore – August 23rd 2022
Pricing Survey H1 2020
Insights into sophistication, tools and trends
Sept 2020

The next generation of pricing actuaries
How AutoML is changing the role of the pricing actuary
July 2021

Pricing & Analytics: Revolution Or Evolution?
Survey 2022 - Europe
May 2022

Electric vehicles
How to address this growing market from an insurance perspective
Sept 2022

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