BEHAVE pre-conference
05 September 2018
Zürich

CHEETAH

CHanging Energy Efficiency Technology Adoption in Households

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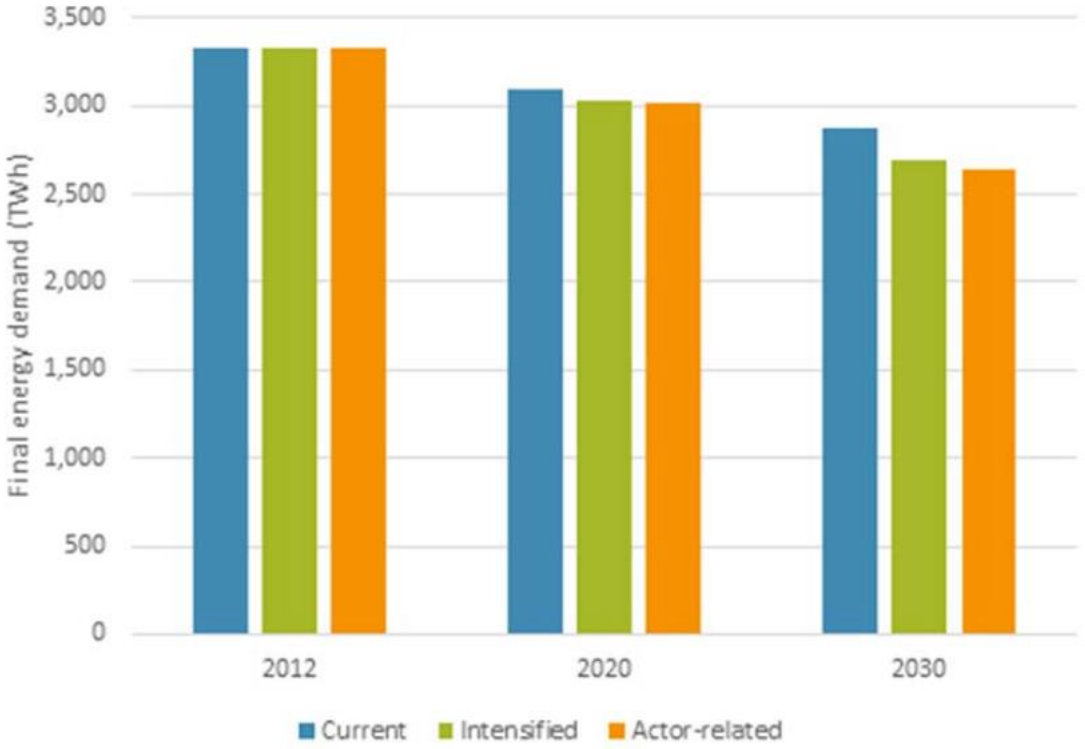
Agenda

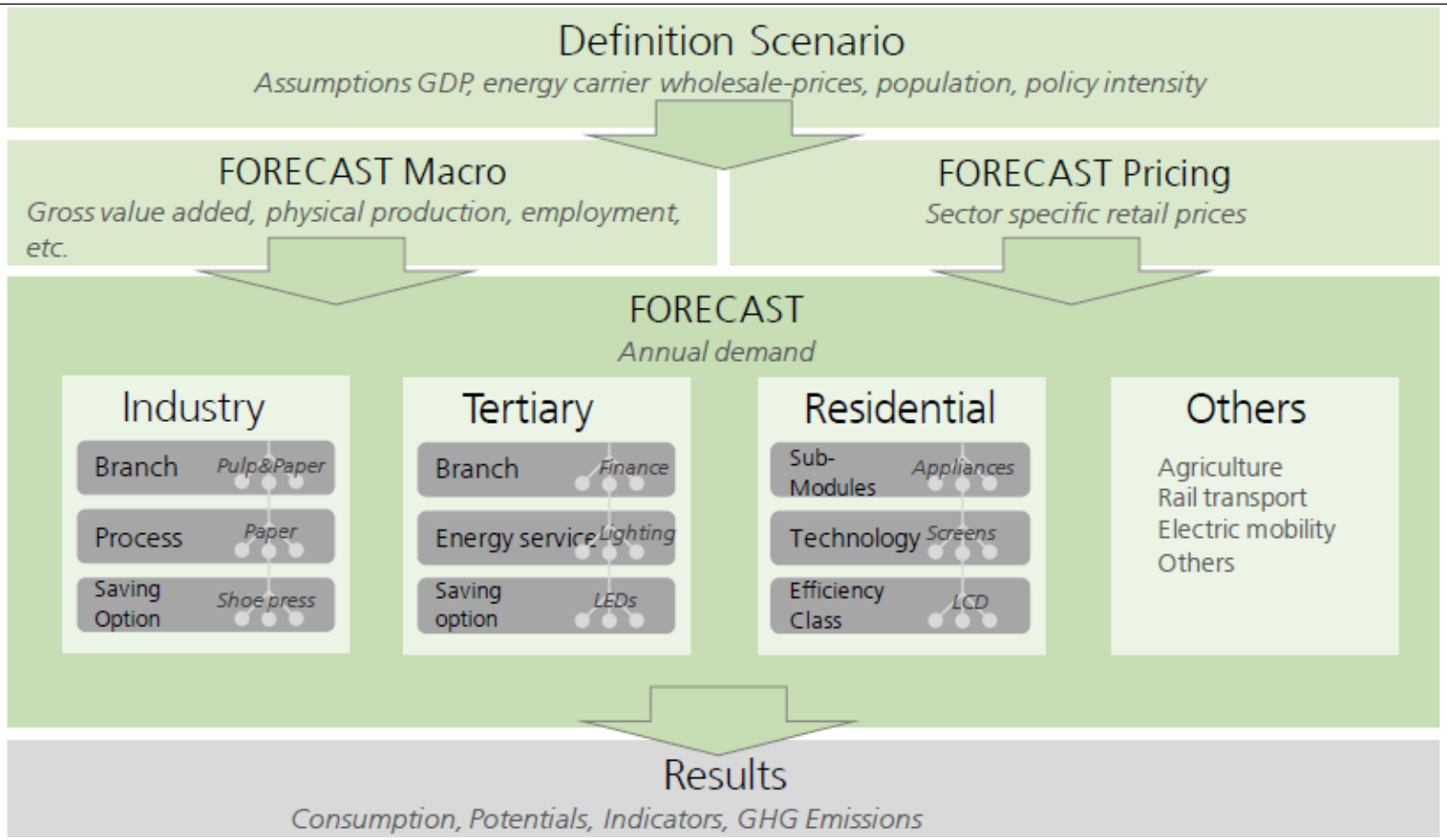
1. Overview of FORECAST Model
2. Approach in CHEETAH
3. Link between Survey and Model
4. Discussion

Modeling Outcomes - BRISKEE

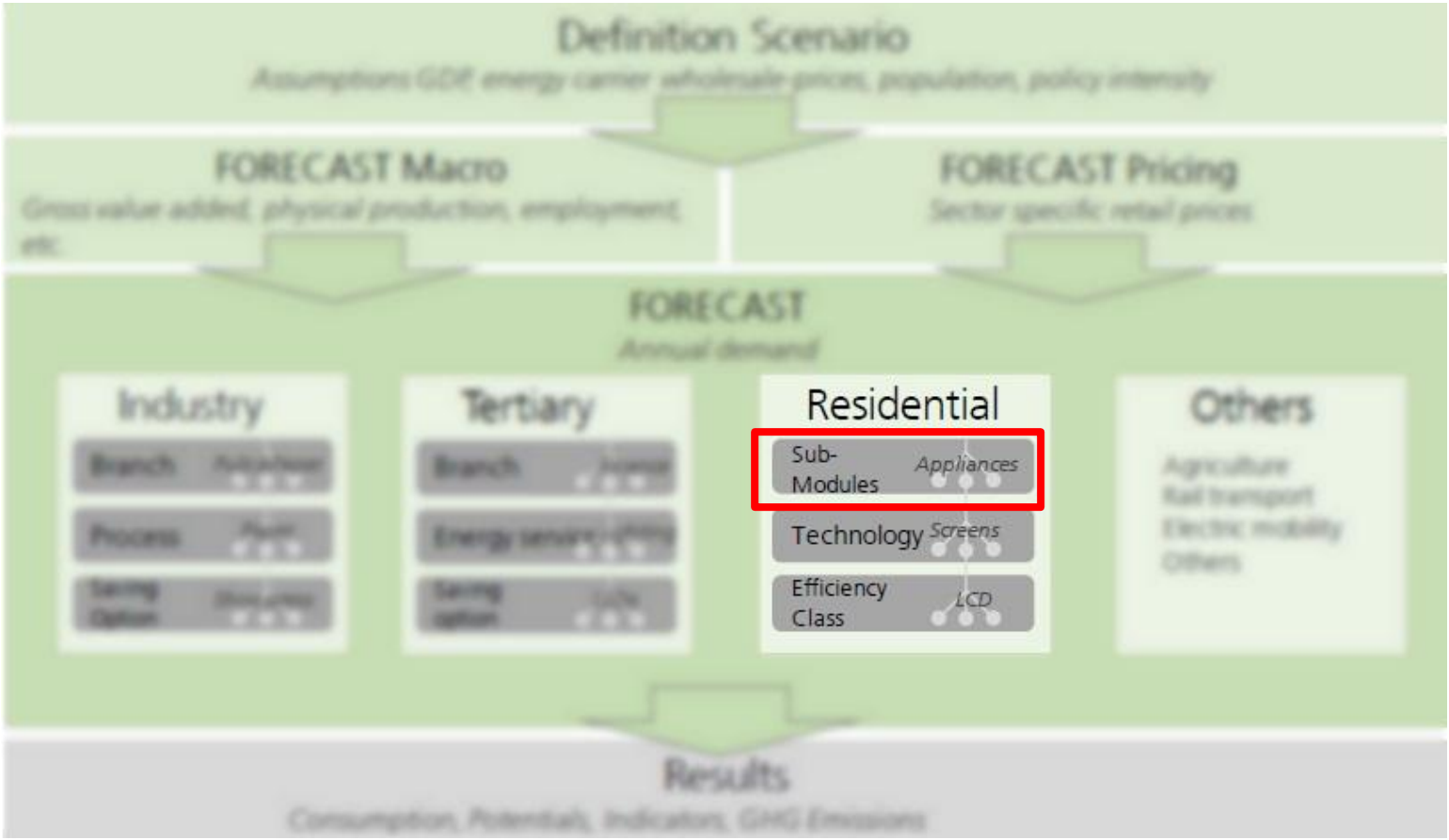


Comparison of final energy for the residential sector (sum of buildings and appliances) in the BRISKEE scenarios

Overview of FORECAST Model



Overview of FORECAST Model



Overview of FORECAST Model

As simplification, the market share of technologies complying the regulation is calculated as follows:

Market share = Logit (life cycle costs/ year)

= Logit (annuity (purchase price) + yearly energy consumption)

= Logit (uf (pp, energy consumption, discount rate, energy price))

Where:

- pp = purchase price
- uf: utility function (in this case: LCC / year)

Overview of FORECAST Model

The Market Share would be simplified as follows:

$$\text{Market share}_{\,i} = \frac{e^{uf_i}}{\sum_{k=1}^{l} e^{uf_k}}$$

Where:

- i: product for which the market share is calculated
- k: all products (i as well as the competing alternatives)
- uf: utility function

Overview of FORECAST Model

Main weak points with the current logic:

1. Preferences of the users are not taken properly into account

2. Utility function is **only based on a cost perspective**, as long as a product can be placed on the market (= fulfill the Ecodesign requirements)

3. All users have the same underlying utility function (no differentiation between end-user groups based on distinct consumption behaviors)

4. Diversity of policies that can be studied in the current model is limited

Approach in CHEETAH

- According to Ecodesign & Energy Labelling implementing regulations, there is a clear link between **EEI** (Energy efficiency Index), **size** (or capacity) and **yearly energy consumption of products (measured on a bench*)** for each regulated product group:

  EEI= h (size, energy consumption)

  and Energy Classes (on the label) are based on EEI

- Purchase decisions are not entirely based on economic rationality. Customers have preferences according to size, energy class... and are ready to pay more for these attributes. Preference depends on country, income,... [see CHEETAH survey]

** : this value can deviate significantly from the real life energy consumption !*

Approach in CHEETAH

- Suggested new approach

Market Share = Logit (uf ($pp_{\textbf{individual}}$, energy consumption, discount rate, energy price))

Where:

- $pp_{\textbf{individual}}$ = Purchase price – $\sum_a WTP_a * X_{\textbf{a}}$

- WTP: Willingness-to-Pay (WTP) as gathered by GEM (survey)
- a: attribute (energy class, size…)
- uf: LCC / year (same as in the existing model)

Approach in CHEETAH

Example (not based on "real" figures or result of the survey):

- A++ refrigerator: Price 750€ Yearly energy consumption 900€ Volume: 320L
- A+++ refrigerator: Price 1000€ Yearly energy consumption 700€ Volume: 335L

- $WTP_{A++ \rightarrow A+++}$: 80 €
- WTP_{size}: 1 € / litre

- Total cost (for utility function of Forecast)
  - A++ = 750 + 900 = 1650 €
  - A+++ (current approach)= 1000 + 700 = 1700 €
  - A+++ (new approach) = (1000 – 80 – 15 x 1) + 700
    = **905**+ 700
    = 905+ 700 = 1605 €

Approach in CHEETAH – Expected Advantages

The expected advantages from the suggested approach are:

1. To account for the **heterogeneity of end users** (including different end-user profiles)

2. To allow **more detailed questions or policies** (related to sufficiency, rescale of the labelling scheme, other changes in MEPS, subsidies, information effects)

3. To better distinguish **decoupling of energy consumption and energy class** in the decision process

Also: Still possible to disable the feature of the new "individual purchase price", so that the logic remains as in the current approach in Forecast

Approach in CHEETAH – Next Steps

1. Step 1: Implement the logic update without distinction of end-user
   - ➔ Analysis of the survey required
   - ➔ Market data (e.g. GfK for refrigerators)

2. Step 2: Implement different profiles of end-users and adapt the code accordingly (keeping in mind some restrictions for some attributes)

   Process of data analysis:

   - ´ideally, using end-user profiles compatible with those of the building model

   - Possibility of identifying certain end-user groups and having them meaningfully clustered in a way that maximizes the differences in investment behavior

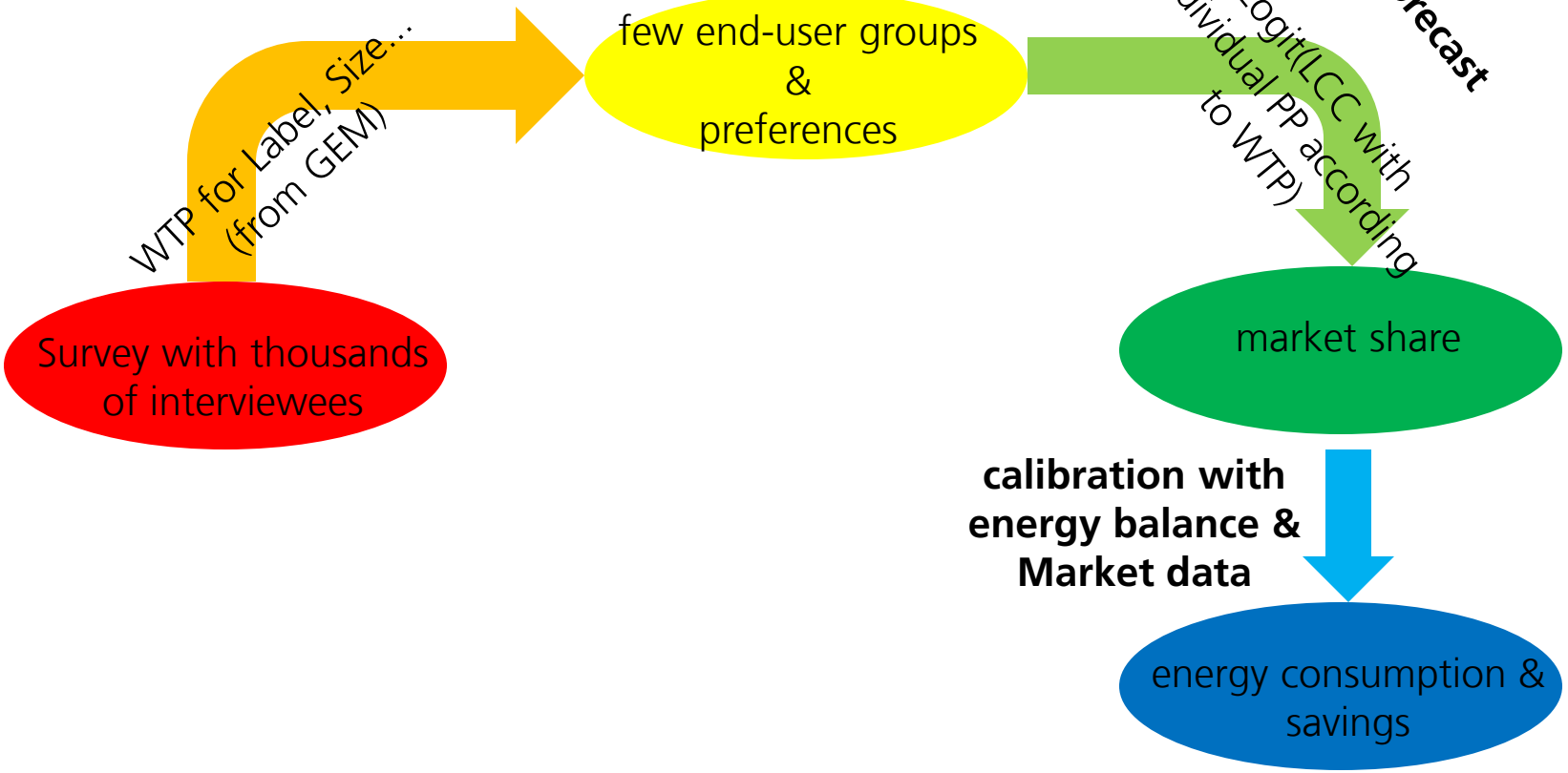
Approach in CHEETAH – Next Steps

3. Include further actors, i.e intermediaries (e.g sellers, utilities)

4. Further improvements for the Forecast Appliances (incl. real life performance,...)

Link Survey-Model

- Overall concept



Thank you for your kind attention!

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