ACES
Across Continents Electric vehicle Services

ACES

100% EVs on the island of Bornholm

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Bornholms Energi & Forsyning A/S

BORNHOLMS ENERGI & FORSYNING

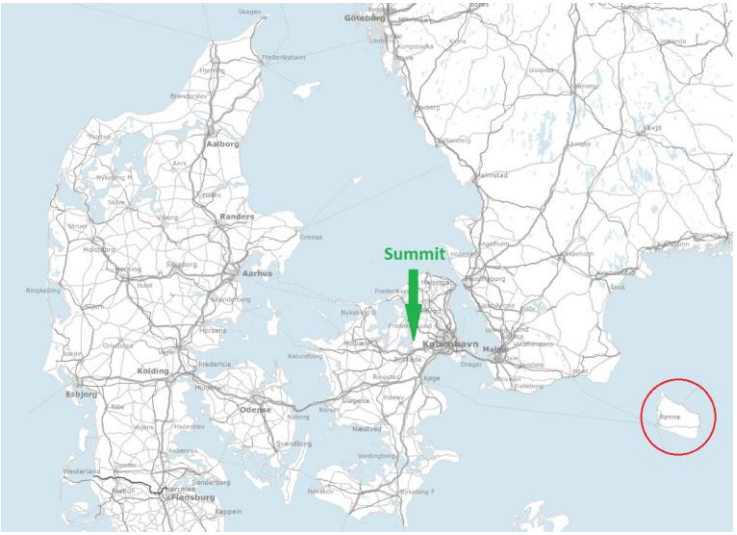
Agenda

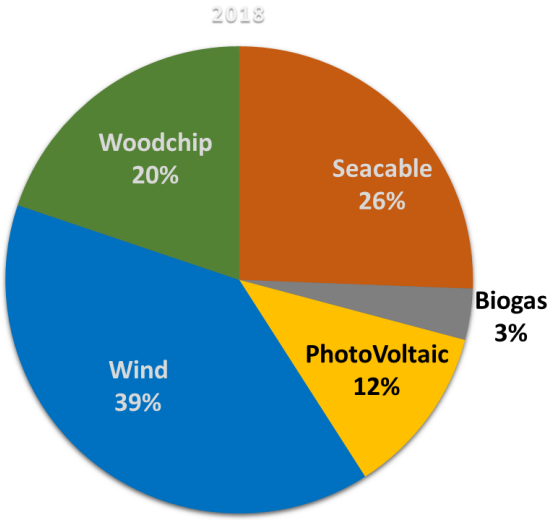
1. Introduction
2. Methodology & model description
3. Simulation results
4. Conclusion and perspectives

BORNHOLMS ENERGI & FORSYNING

1. Introduction

- BEOF
  - Multiutility company 160
  - Green transition & securing quality of Power etc..
  - Projects ♥ Citizens
  - High RES
  - EV – Friend or Foe?





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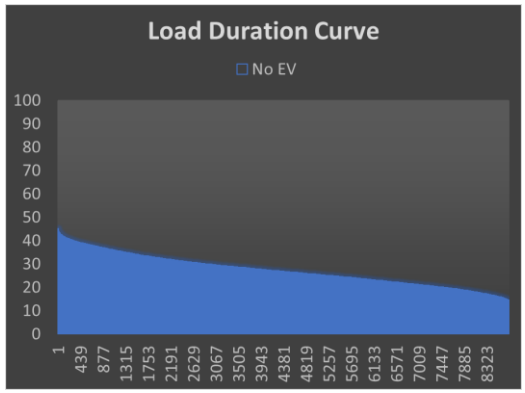
1. Introduction

- Simulation-model

17,500 EV+100% V2G

  - Load duration curve
  - Storage capacity
  - Economy for
    - EV owners
    - Bornholm



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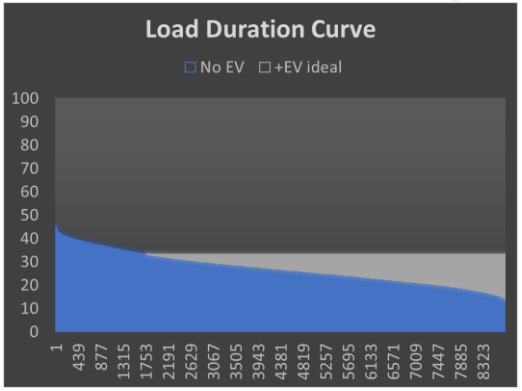

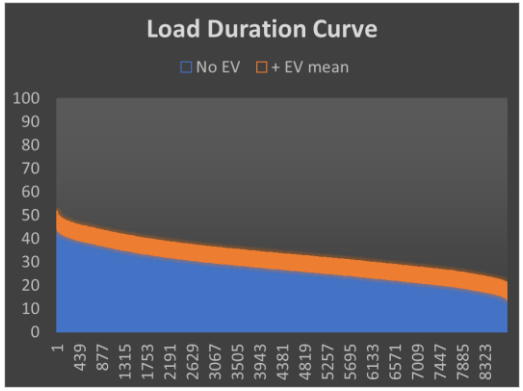

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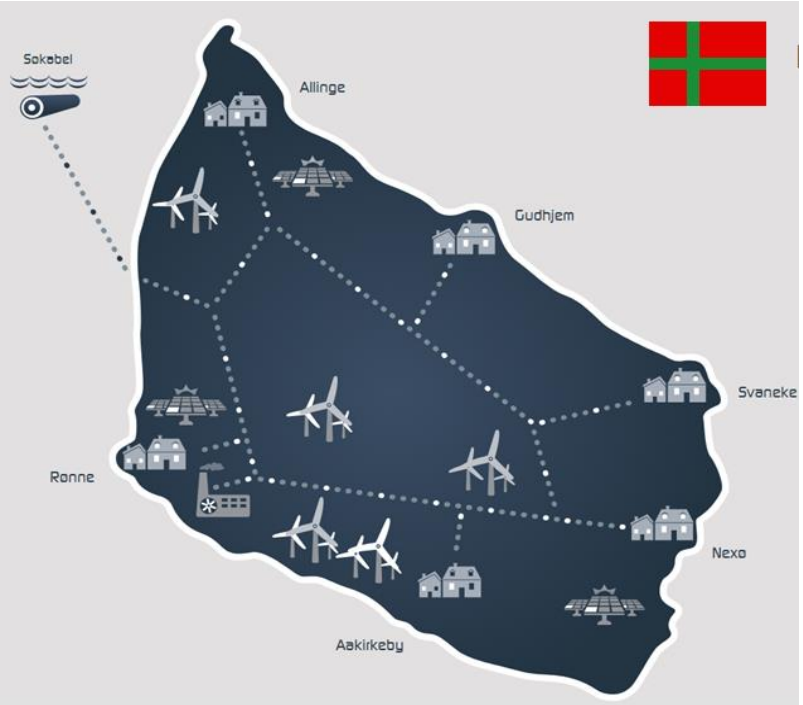
2. Methodology & model description

- Bornholm
  - 40,000 inhabitants
  - Mini-community hospital, schools, industry etc.
  - Scalability
  - Electrical
    - 60 kV / 60 MVA sea cable
    - DK-2 system



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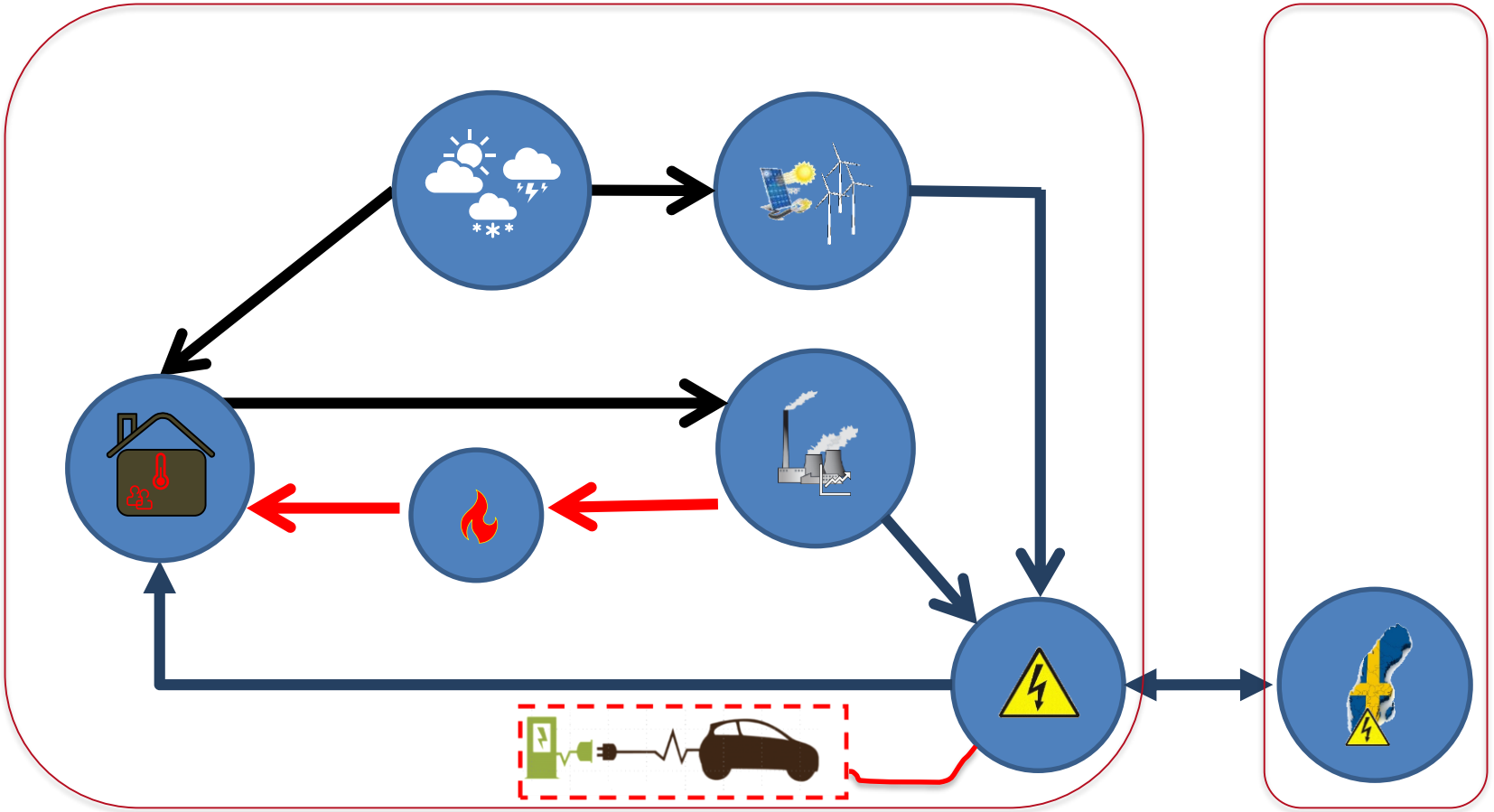
2. Methodology & model description

Simulation-model + EV ATOM



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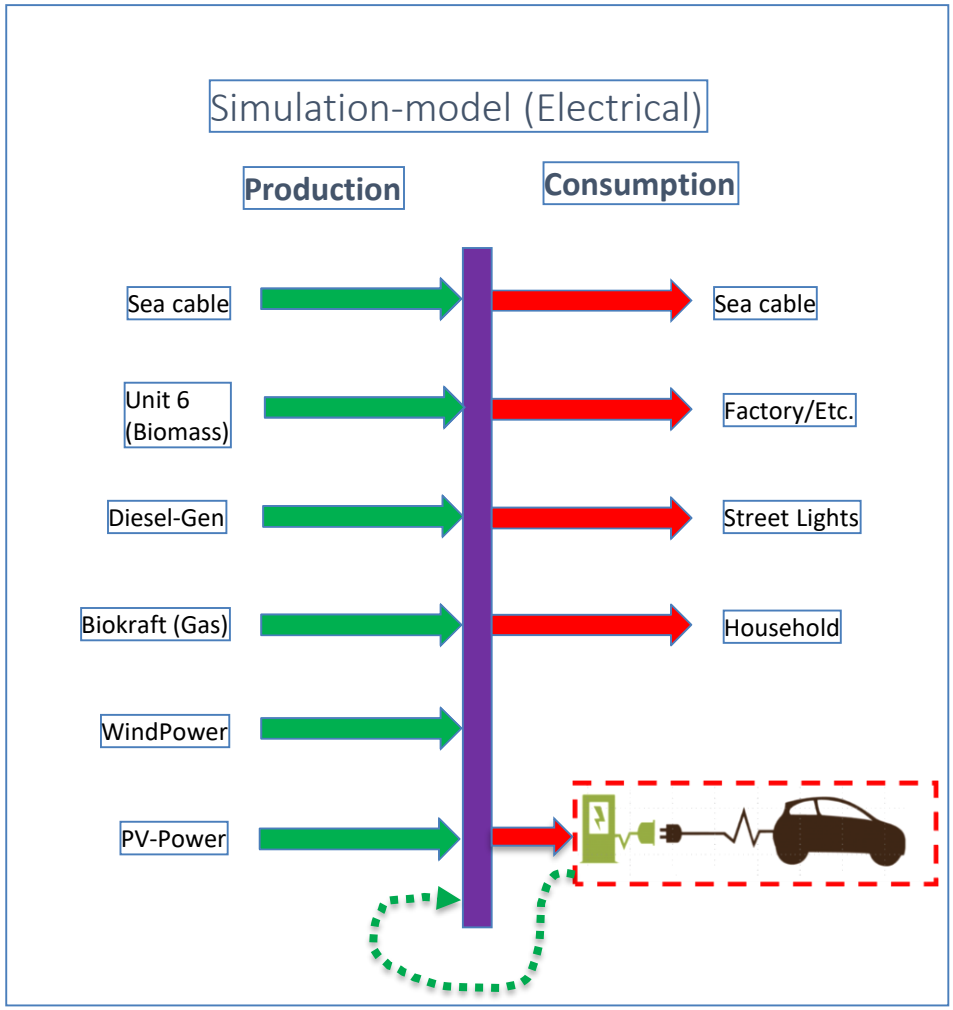
2. Methodology & model description



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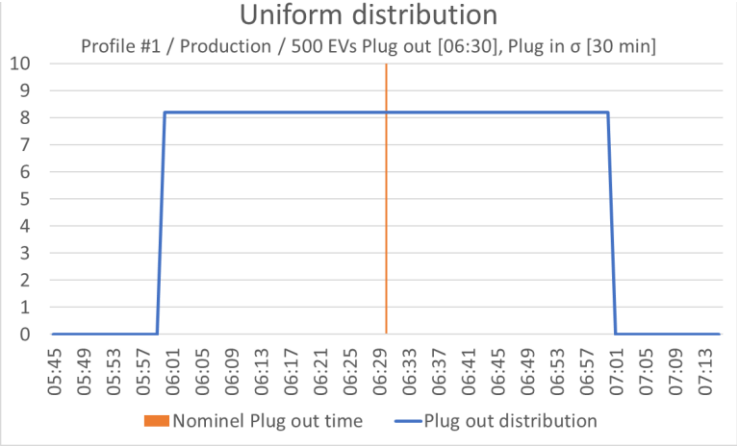
2. Methodology & model description

- Base:

  10,000 Leaf 24 kWh on-board telematic system

- Charging rules
  - Dumb
  - V1G
  - V2G

Profile #	#1	
Type	Production	
Charge rule	9=V2G	
#EVs	2,500	
Capacity [kWh]	40	
Charging rate [kW]	3.6	
Discharging rate [kW]	3.6	
Charge loss [pct.]	10	
Discharge loss [pct.]	10	
Km/kWh .	5	
Behavior	Daily	Weekend
Plug out [time]	06:00	10:00
Plug out σ [min]	30	120
Plug in [time]	15:30	16:00
Plug in σ [min]	30	240
Km/trip	35	38



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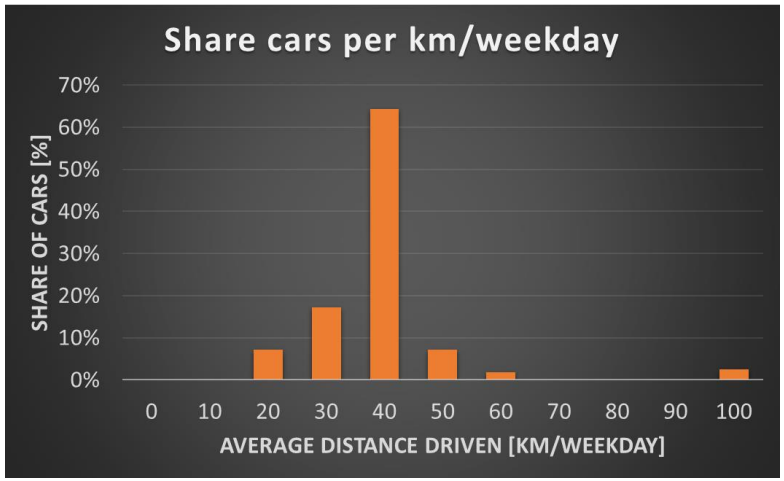
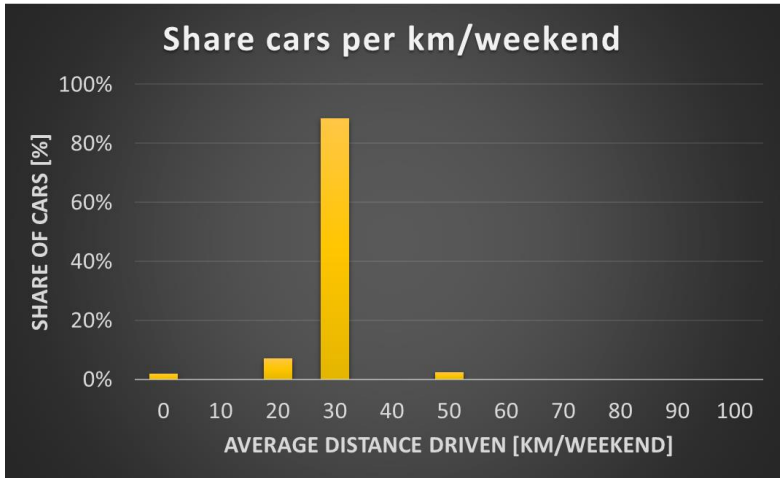
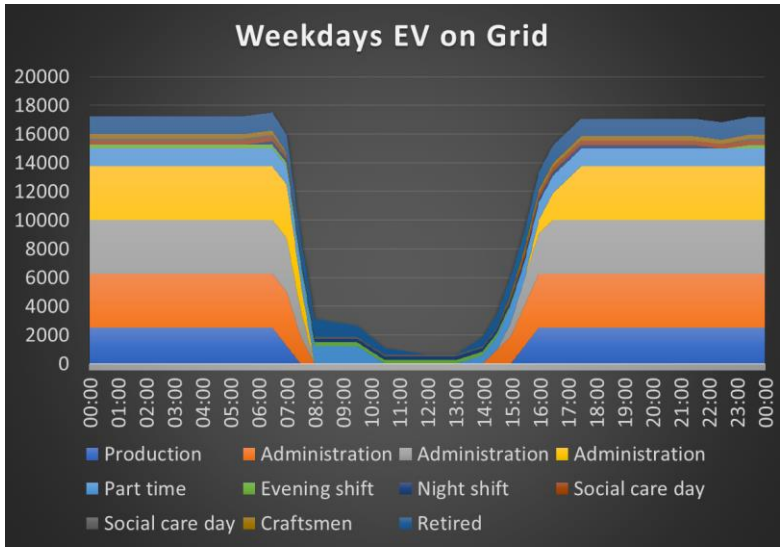
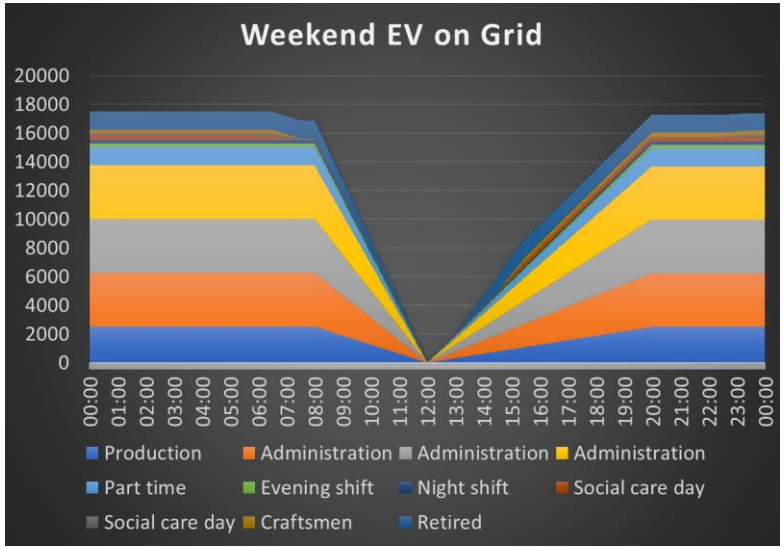
2. Methodology & model description









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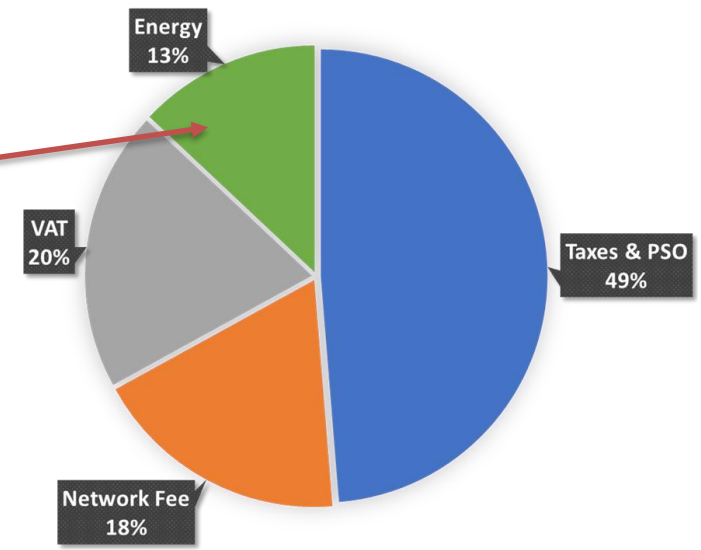
2. Methodology & model description

- Overview Scenarios
  - Charging type
  - Distribution

SCENARIO	Dumb	V1G	V2G
1	100%		
2	80%	20%	
3	20%	80%	
4		80%	20%
5		20%	80%
6			100%

- Nord Pool*

  DK2 Spot Market
  Household bill:
  13 % represent energy part



*)https://www.nordpoolgroup.com/

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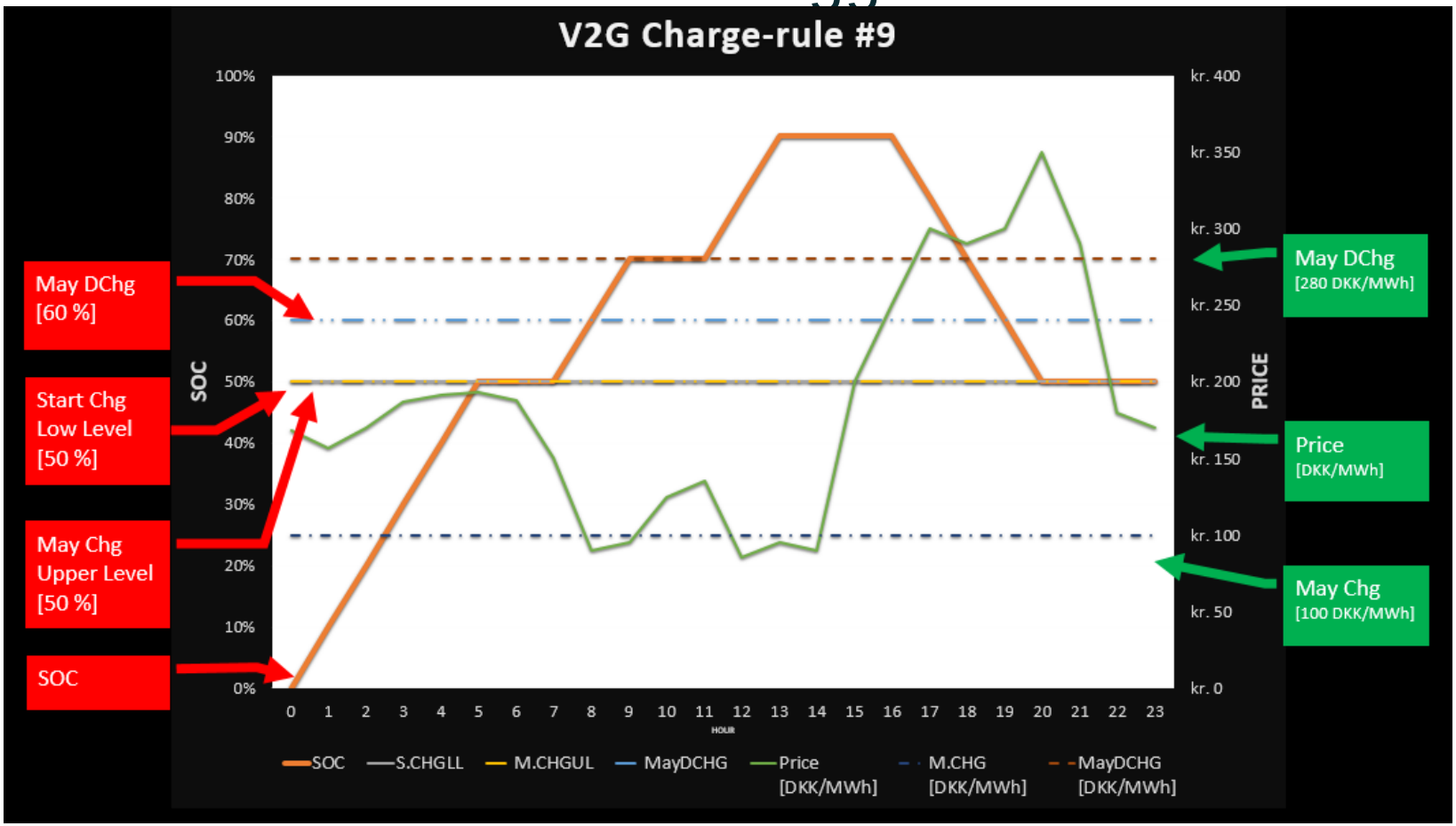
2. Methodology & model description

- Combination of different triggers



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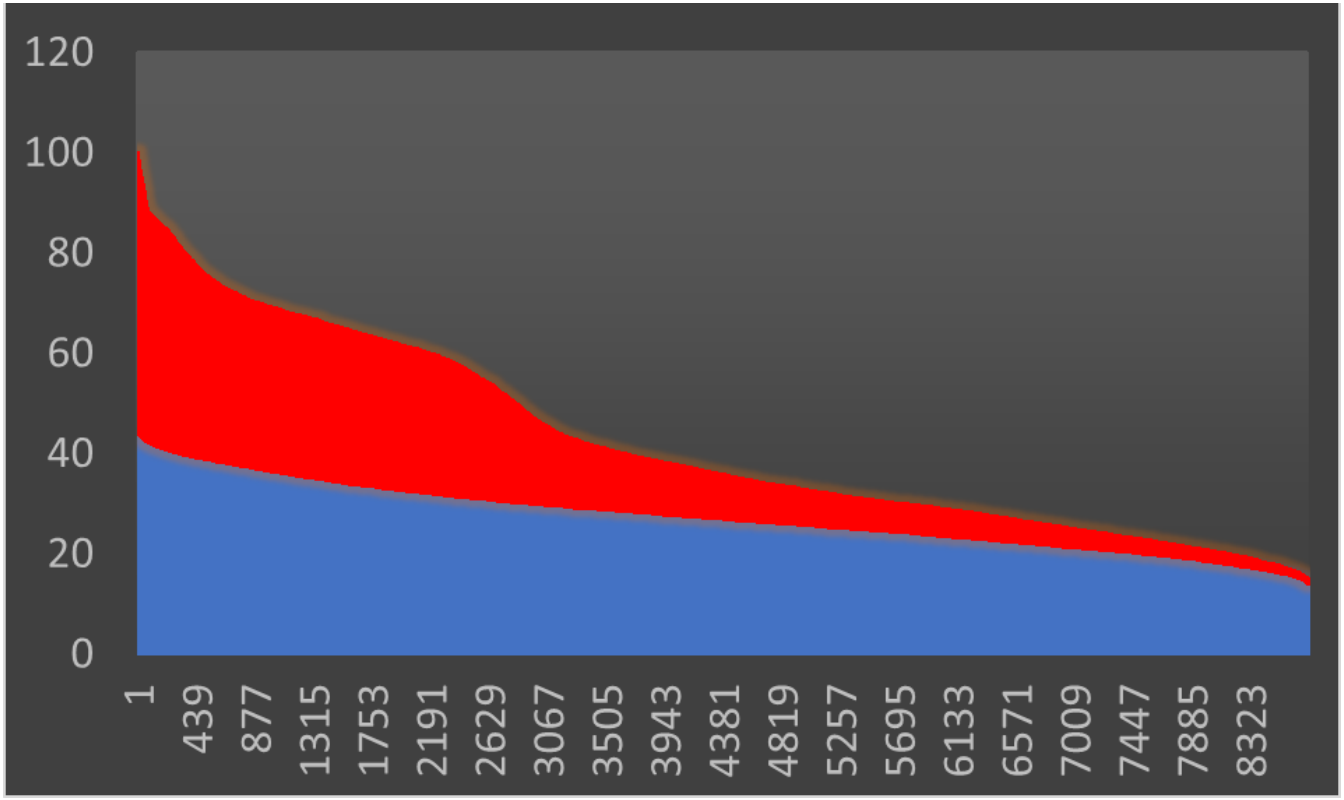
3. Simulation results

- Load duration curve V2G (DKK200)



Blue area: currently, Read area: EV contribution

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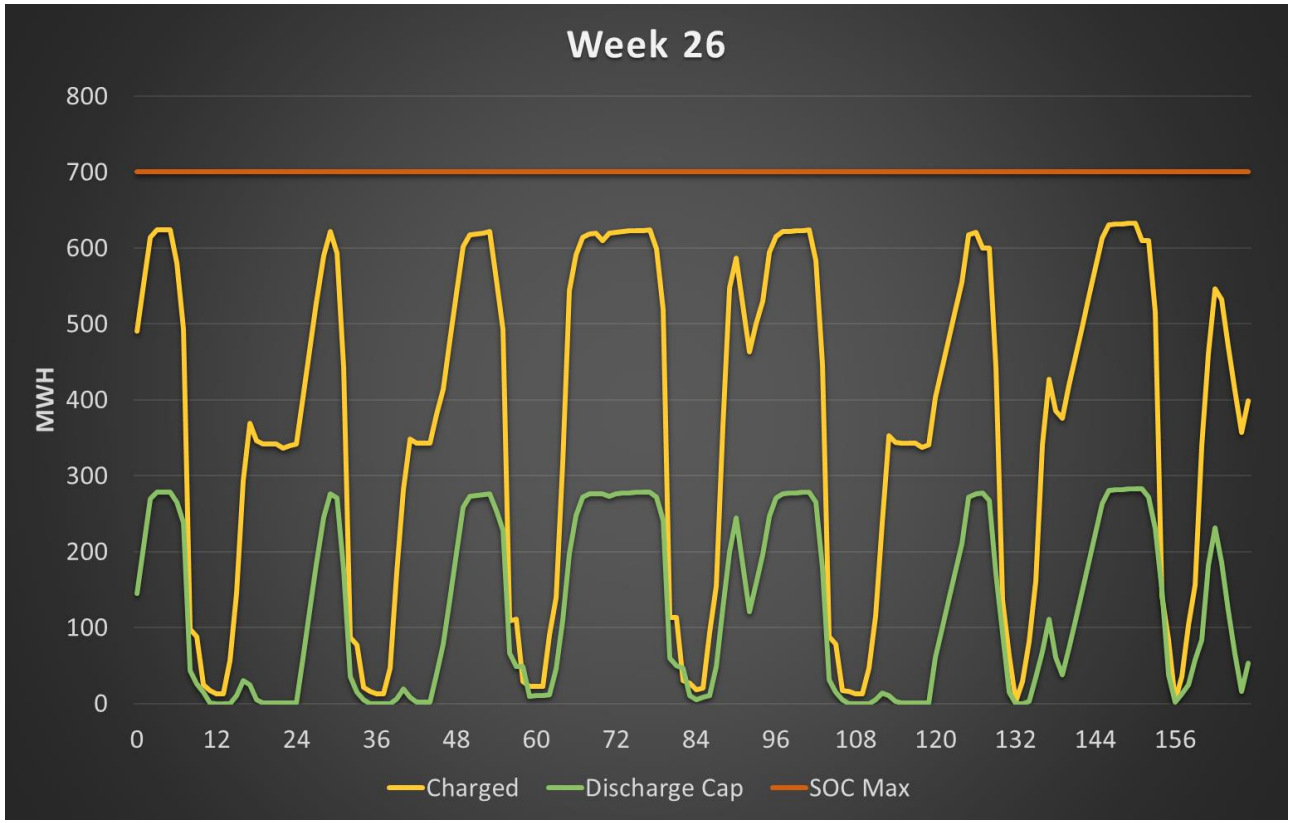
3. Simulation results

- Virtual battery



Discharge capacity varies from ~ 0 - 250 MWh

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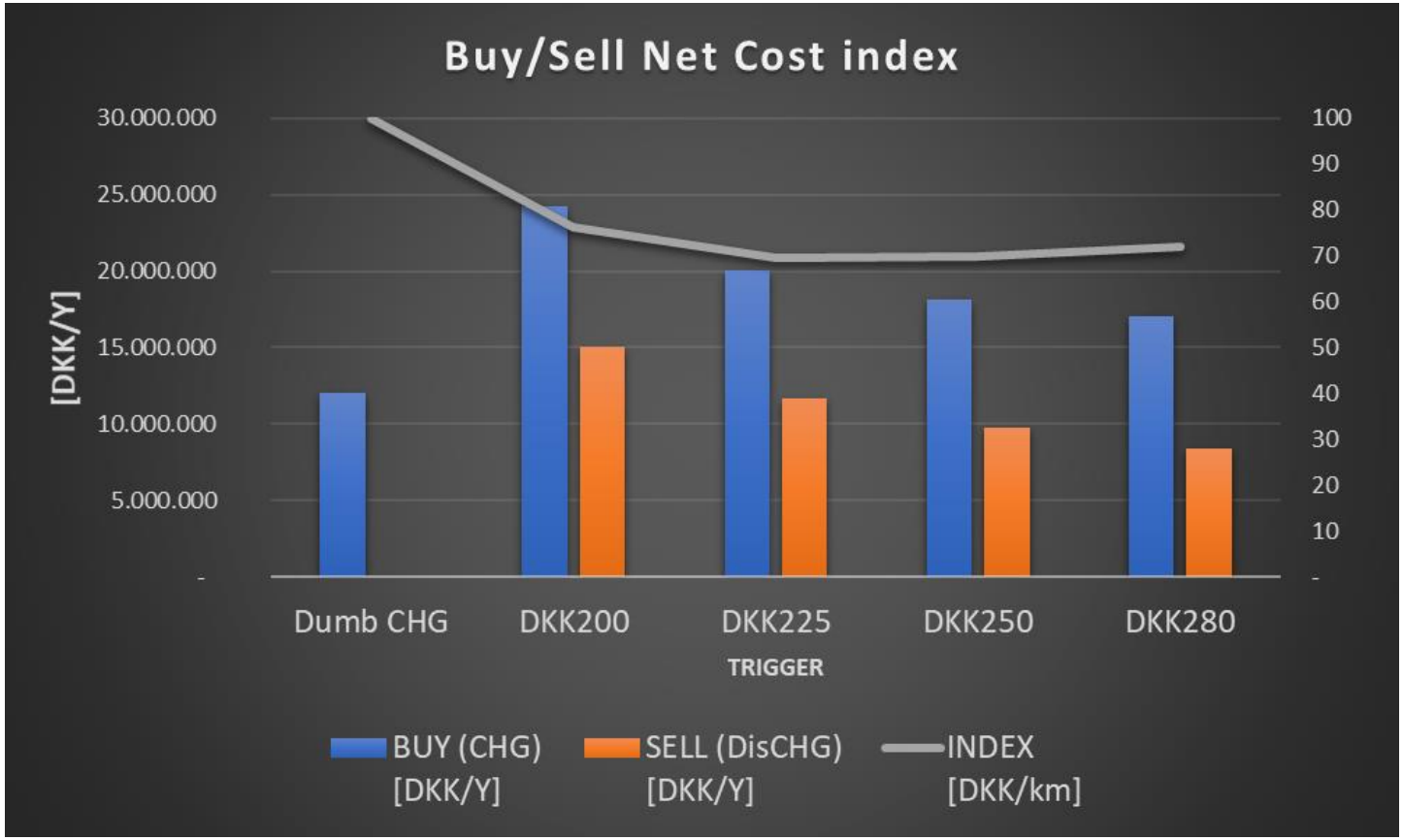
3. Simulation results

Economic impact – EV owner



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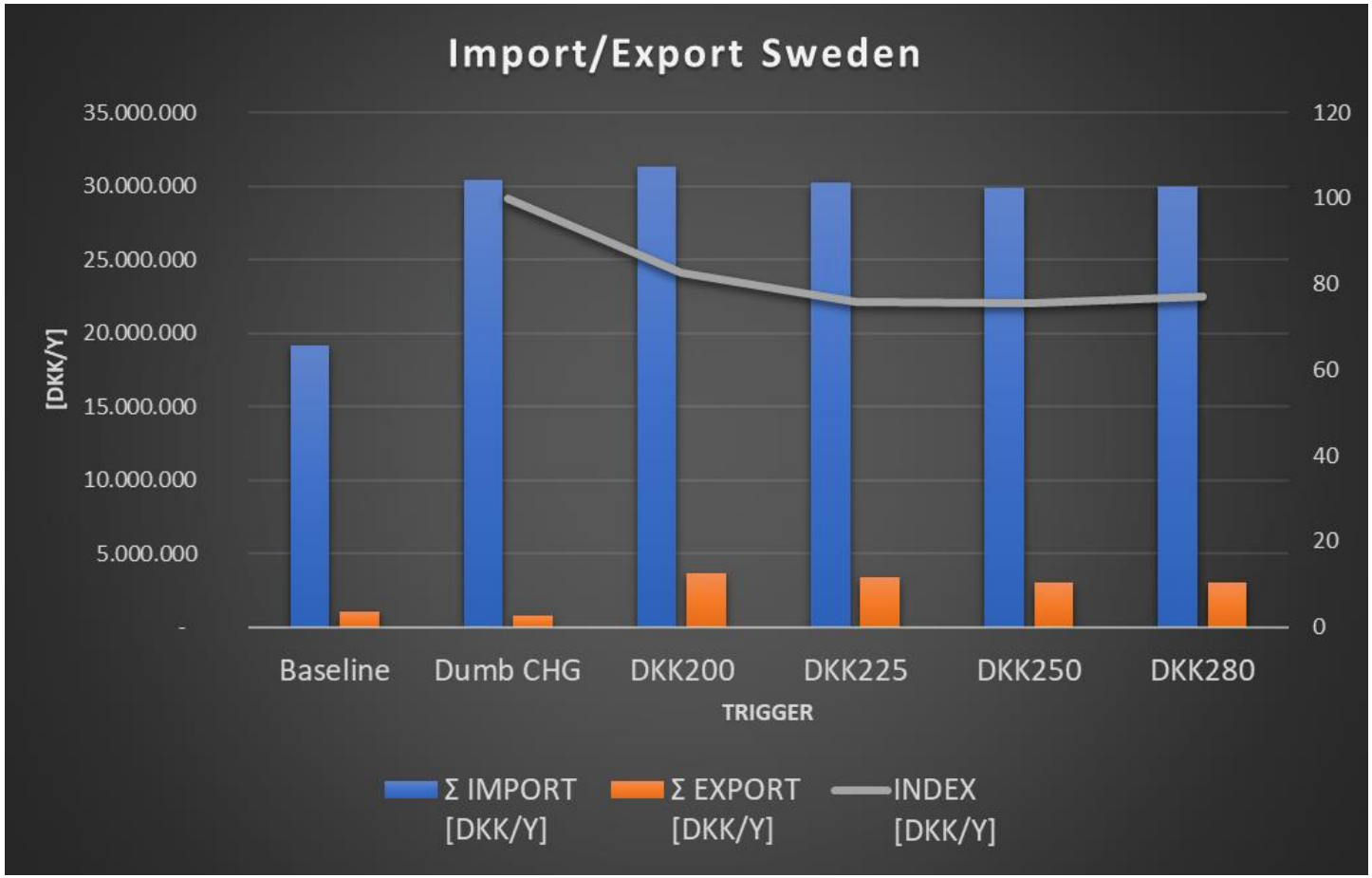
3. Simulation results

Economic impact – Bornholm



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4. Conclusion

- Peak load > 2 x P_{max}
- Virtual battery [~0 ; 250] MWh
- 100 % V2G, save 30 % ~ 168 DKK/Year/EV
- Bornholm save 24% ~ 2,8 mio. DKK/Year

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4. Perspectives

- 1. Driven distance > travel study
- 2. Plug in rate ≠ 100 %
- 3. Diverse charger setup
- 4. Mitigating ‘cooking peak’

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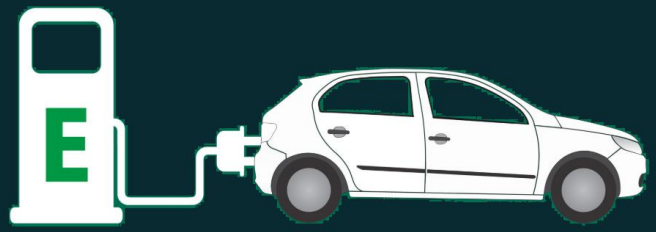
Friend

Thanks for listening