



bEhaVioral Insights anD Effective eNergy policy acTions

EU Sustainable Energy Days - Preliminary results from the project

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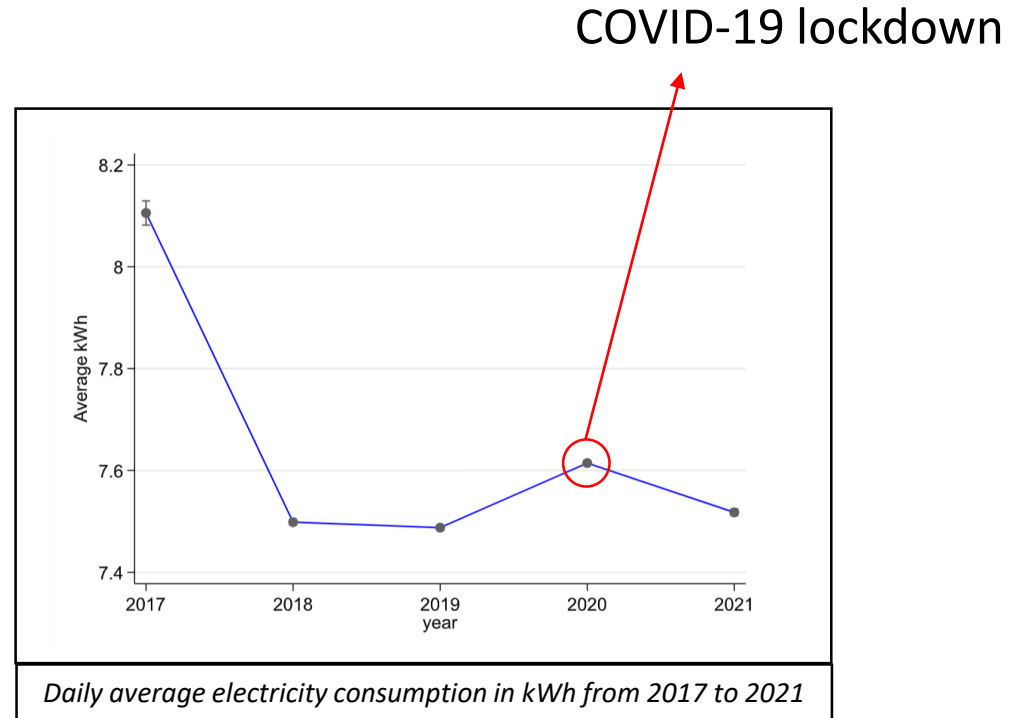
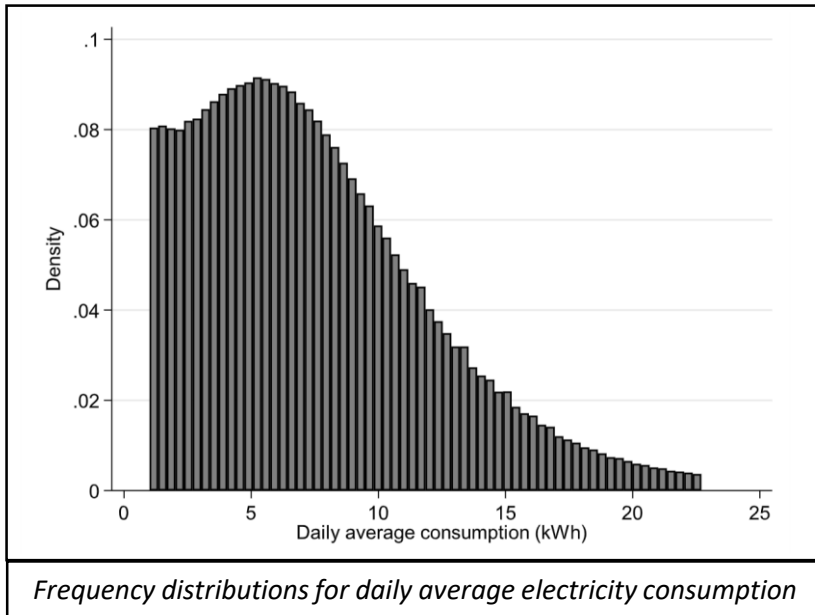


# Agenda

- The energy market in Greece and Sweden
- Energy consumption patterns and COVID-19
- EVIDENT energy conservation interventions for policy making
  - Consumption feedback and peer-comparison
  - Efficient large-scale interventions using Machine Learning
  - Average price bias and individuals' economic decisions

# The energy market in Greece and Sweden

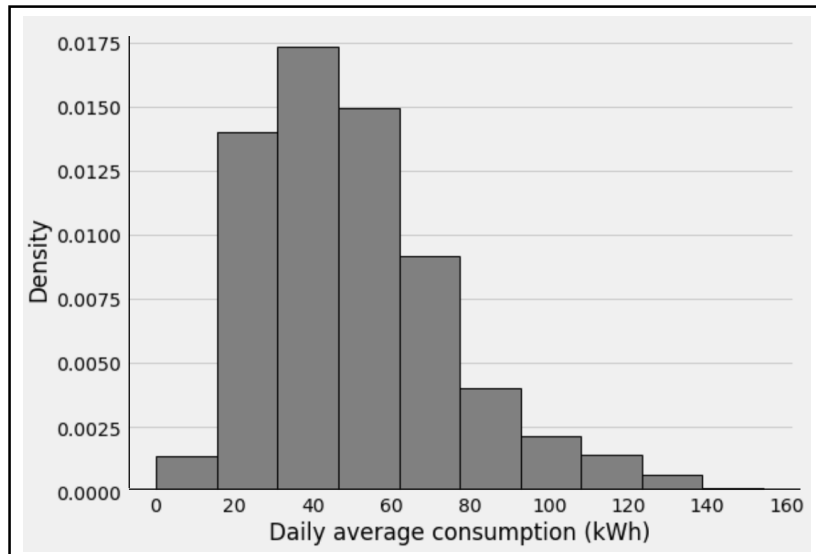
## Greece energy market from 2017 to 2021



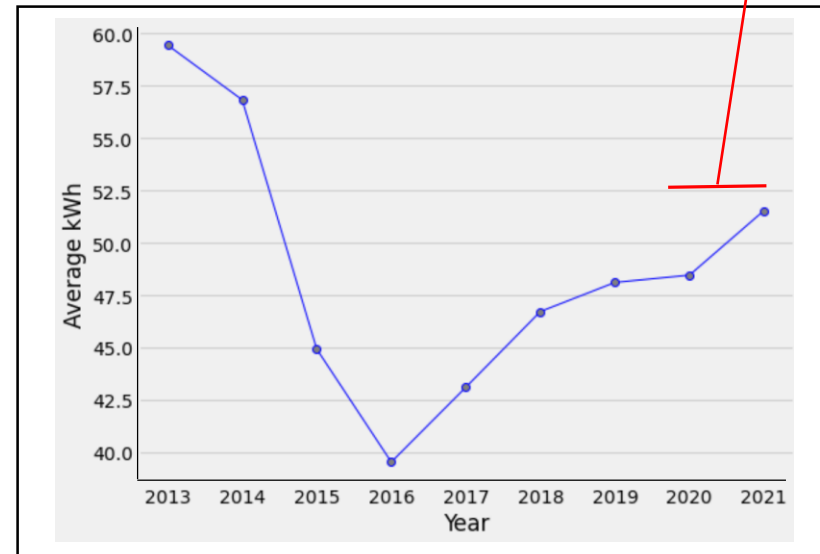
\* Data are provided by Public Power Corporation S.A. the biggest electric power company in Greece

# The energy market in Greece and Sweden

## Swedish energy market from 2013 to 2021



*Frequency distributions for daily average electricity total consumption*



*Daily average electricity total consumption in kWh from 2013 to 2021*

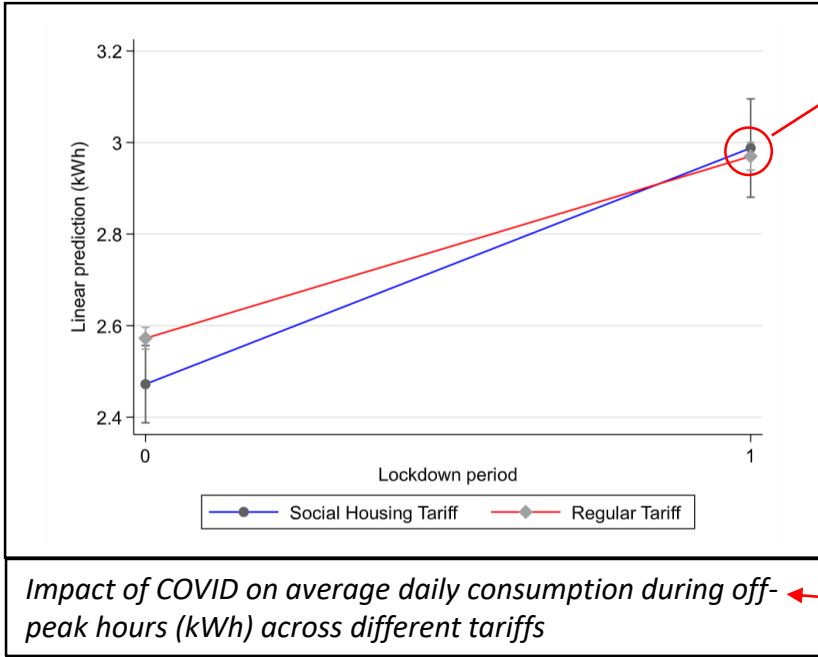
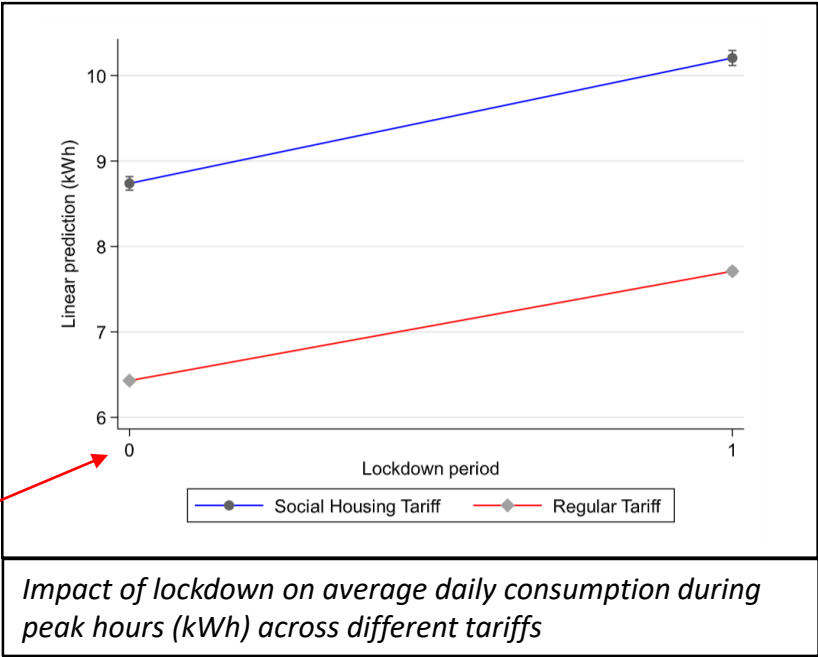
\* Data are provided by CheckWatt, an SME that helps Swedish households and companies become smarter and more sustainable in their energy usage

# Energy consumption patterns and COVID-19

## Greece undergo two lockdown periods

First lockdown period: 13/03/2020 to 18/05/2020

Second lockdown period: 07/11/2020 to 08/03/2021 (for retail market) and 03/05/2021 for individuals



Off-peak hours: 23.00 – 07.00  
Peak hours: 07:01 – 22:59

	Regular Tariff	Social Housing Tariff
Day consumption (peak)	19,9%	16,7%
Night consumption (off-peak)	15,2%	20,6%

*Percentage changes of average daily electricity consumption during COVID across tariffs and hours off peak*

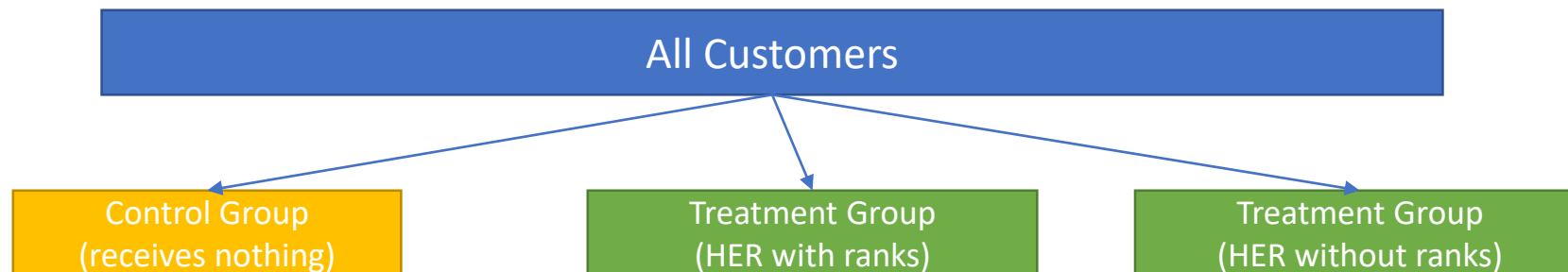
# EVIDENT energy conservation interventions for policy making

- EVIDENT project will examine how specific low-cost behavioural-based interventions could potentially correct consumers energy-related misperceptions and enhance energy efficiency
  - Field experiment to estimate the impact of consumption feedback and peer-comparison mechanism
  - Machine learning methodologies to create efficient large-scale interventions
  - Examine Average price bias and individuals' economic decisions

# EVIDENT energy conservation interventions for policy making

## Consumption feedback and peer-comparison - CheckWatt

- EVIDENT consortium designs and implements a Field Experiment with approx. 900 CheckWatt customers
- Through a Randomised Control Trial, the consortium prepares and sent every two weeks Home Energy Reports (HERs) to the customers
- HER have been widely used in energy efficiency programs based on RCTs indicating the importance of energy conservation nudges [5-6]
- 2 treatment groups and 1 control – the differentiation is on customer “rank”



# EVIDENT energy conservation interventions for policy making

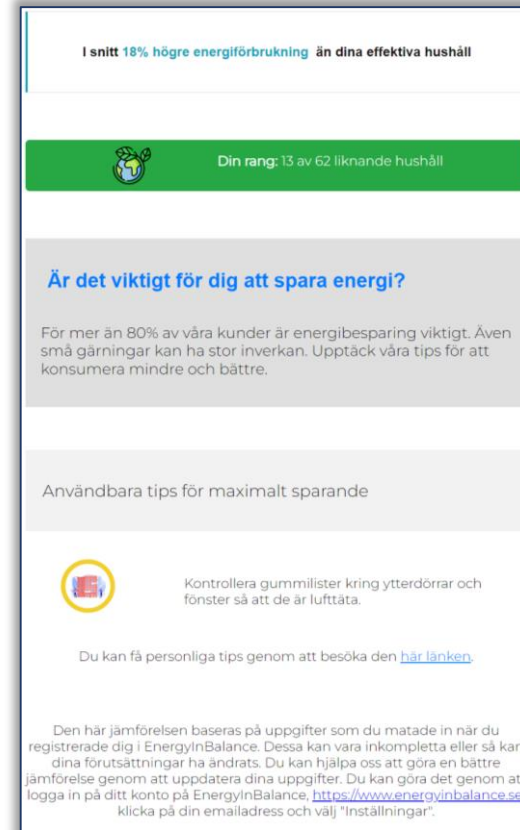
## Consumption feedback and peer-comparison - CheckWatt HER



Company information

Blue line: household's historical average energy consumption  
Orange line: comparison with neighbours  
Green line: comparison with effective neighbours

Household performance (emojis)



percentage difference between household and efficient neighbours

customer ranking

Injunctive feedback

Energy conservation tips

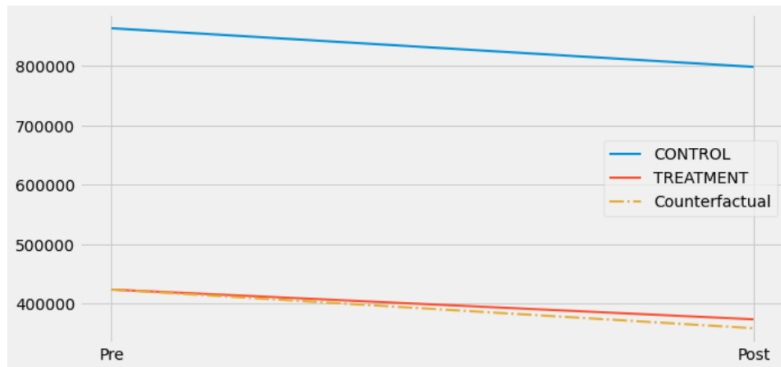
Information message for fill up a demographics survey



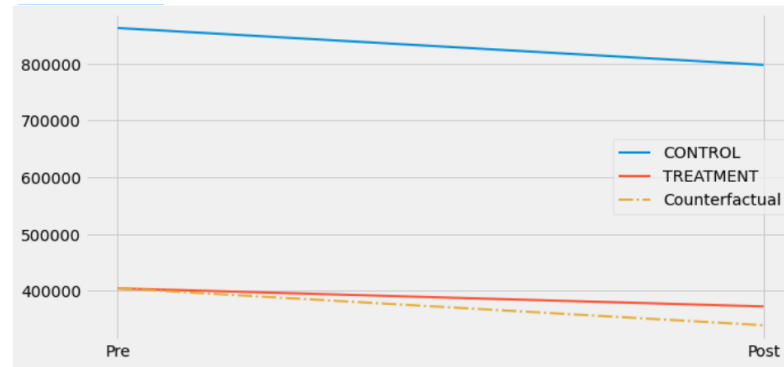
# EVIDENT energy conservation interventions for policy making

## Consumption feedback and peer-comparison - CheckWatt Preliminary Results

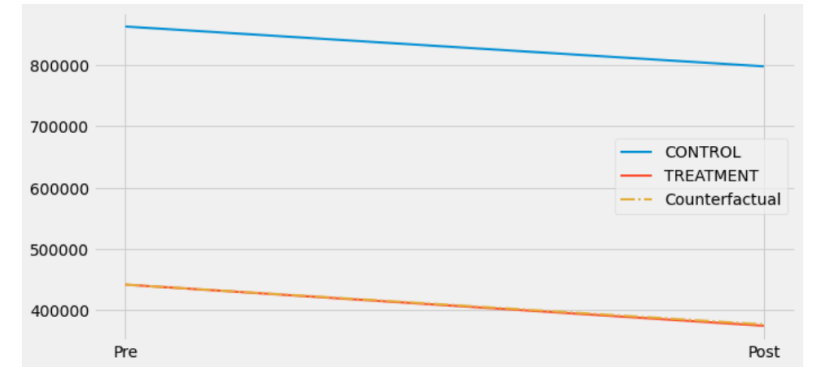
- Average Treatment Effect: -4.18%
- Average Treatment Effect for treatment group received HER with the “rank” section: -9.76%
- Average Treatment Effect for treatment group received HER without the “rank” section: -0.58%



Average Treatment Effect -4.18%



ATE for treatment group received HER with the “rank” section -9.76%



ATE for treatment group received HER without the “rank” section -0.58%

# EVIDENT energy conservation interventions for policy making

## Consumption feedback and peer-comparison – Public Power Corporation

- PPC has designed and launched a new service called “myEnergyCoach”
- “myEnergyCoach” regards information for promoting energy conservation and personalized tips (such as peer comparison)
- The new tool includes more than 200,000 customers
  
- EVIDENT will start analysing “myEnergyCoach” data in November 2022 since the new service will be online for approx. for 10 months

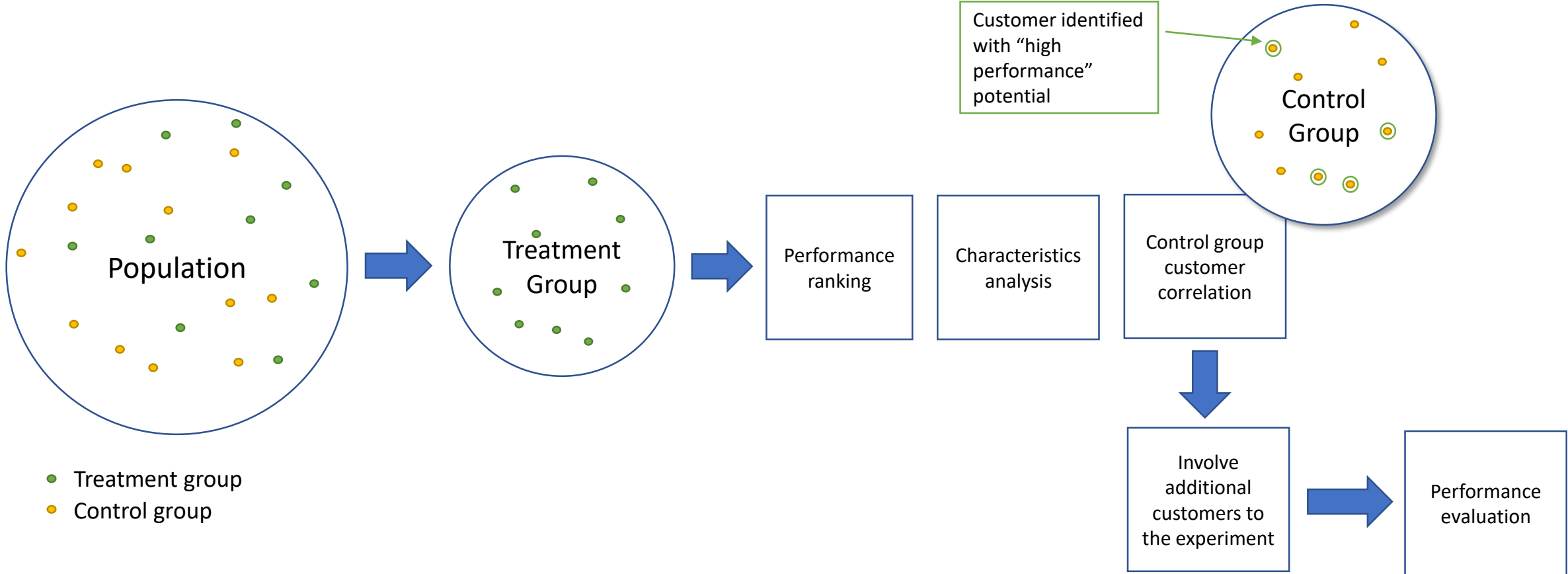
# EVIDENT energy conservation interventions for policy making

## Efficient large-scale interventions using Machine Learning

- Provide a framework to efficiently scale up a field experiment at low cost
- Leveraging ML classification algorithms to identify customers' characteristics that leads to greater impact (treatment effect)

# EVIDENT energy conservation interventions for policy making

## Efficient large-scale interventions using Machine Learning - Concept



# EVIDENT energy conservation interventions for policy making

## Efficient large-scale interventions using Machine Learning - Preliminary Results

- **Support Vector Classifiers** seems to outperform the rest algorithms
- 20% of the most well performed clients will be class 1 and class 0 the rest
- Dataset split 70% - 30%, Trainingset and Testset respectively
- SVC kernel = linear, C = 5, Gamma = 1500

Metric	In-sample	Out-sample
Accuracy	0.782	0.797
F1	0.568	0.649
Precision	0.445	0.558
Recall	0.793	0.774

In-sample Confusion Matrix		
	Pred. Class 0	Pred. Class 1
Class 0	190	54
Class 1	11	43

Out-sample Confusion Matrix		
	Pred. Class 0	Pred. Class 1
Class 0	76	21
Class 1	7	24

# EVIDENT energy conservation interventions for policy making

## Average price bias and individuals' economic decisions

- Guarantee fixed-cost recovery from “green energy investments” by introducing the two-part tariff (TPT) pricing scheme [7]
- Key assumption of TPT schemes: consumers discriminate fixed from marginal costs [7] [8] [9]
- The fixed-cost recovery via fixed charges critically depends on the ability of consumers to distinguish fixed costs from marginal costs

# EVIDENT energy conservation interventions for policy making

## Average price bias and individuals' economic decisions – EVIDENT quasi-experiment

- Implement a quasi-experiment in the framework of the **marginal price bias**
- Consumers show a cognitive difficulty in understanding nonlinear price systems thus responding to average prices
- elicit consumers' perceptions about different pricing schemes

# EVIDENT energy conservation interventions for policy making

## Average price bias and individuals' economic decisions - Price perceptions questions

- “Assuming that your yearly energy consumption is exactly X kWh, which one of the following tariffs would you choose as the most cost effective?”
- Participants receive on their screen different sets of tariffs
  - Differentiation on the number of tier tariff schemes (e.g. two-tier tariff schemes, three-tier tariff schemes)
  - Differentiation on the consumption per tier tariff scheme (e.g. same kWh in each tier, more kWh in the first tier and less in the second tier and vice versa)
- Each participant will be randomly assigned to a few set of potential questions



# EVIDENT energy conservation interventions for policy making

## Average price bias and individuals' economic decisions - Example

- “Assuming that your yearly energy consumption is exactly X kWh, which one of the following tariffs would you choose as the most cost effective?”

	Price specifics	Yearly cost (€)
1.	0.15 €/kWh for 6,000 kWh	900€
2.	0.12 €/kWh < 3,000 kWh and 0.17 €/kWh > 3,001 kWh	<b>870€</b>

Two-part tariff options –  
Even distribution of  
consumption loads  
between tiers

	Price specifics	Yearly cost (€)
1.	0.15 €/kWh for 6,000 kWh	900€
2.	0.12 €/kWh <1,500 kWh, 0.15 €/kWh for 1,501kWh - 2,500kWh and 0.16 €/kWh > 2,501 kWh	<b>890€</b>

Three-part tariff options –  
Uneven distribution of  
consumption loads  
between tiers

# References

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Thank you for your attention

Questions?

