



# Low Carbon Ukraine

Policy advice on low-carbon policies for Ukraine

Supported by:



Federal Ministry  
for the Environment, Nature Conservation  
and Nuclear Safety

based on a decision of the German Bundestag

## The effects of COVID-19 on Ukraine's electricity consumption in 2020

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Berlin/Kyiv – 2020

Implemented by

 Berlin  
Economics

## Key Messages

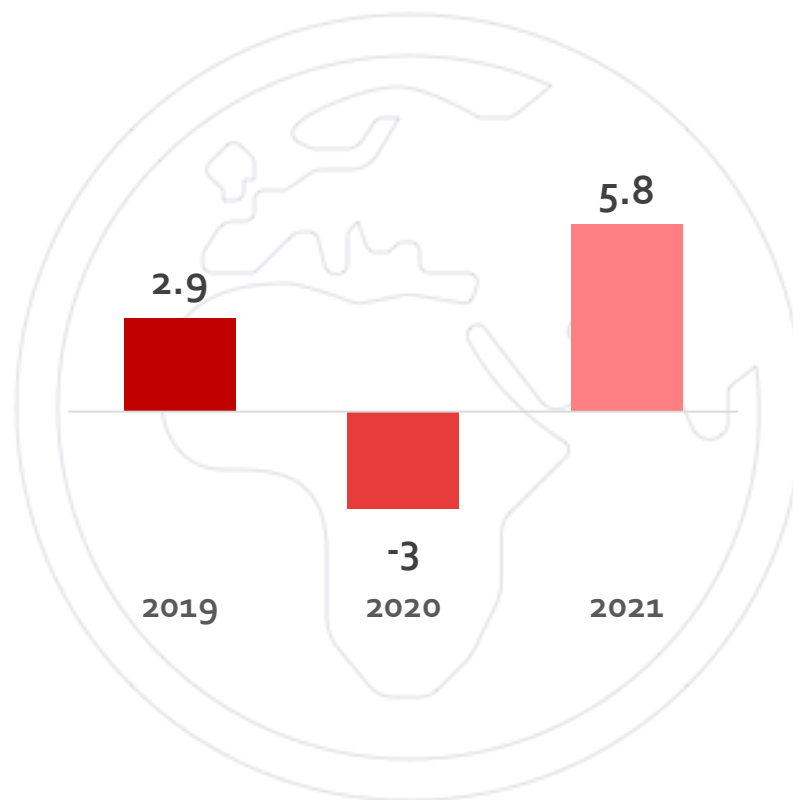
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- 1 We estimate the impact of the COVID-19-induced economic crisis on Ukraine's electricity consumption
- 2 Annual electricity consumption to decrease by **5%** in best- and **8%** in worst-case scenario in 2020
- 3 The effects of the crisis on wholesale electricity prices and on the generation mix might not be straightforward due to market regulations and require further assessment

## The COVID-19 crisis massively affects global output

- Global lockdowns are a large negative shock for economies around the world
- Ukraine has introduced strict lockdown measures on March 16/17 and started to gradually lift them from mid-May
- Economic impact of COVID-19 on Ukraine will be both due to domestic containment measures and external shocks through global markets
- Ukraine's GDP expected to significantly contract in 2020

Global growth projections  
(percentage change)

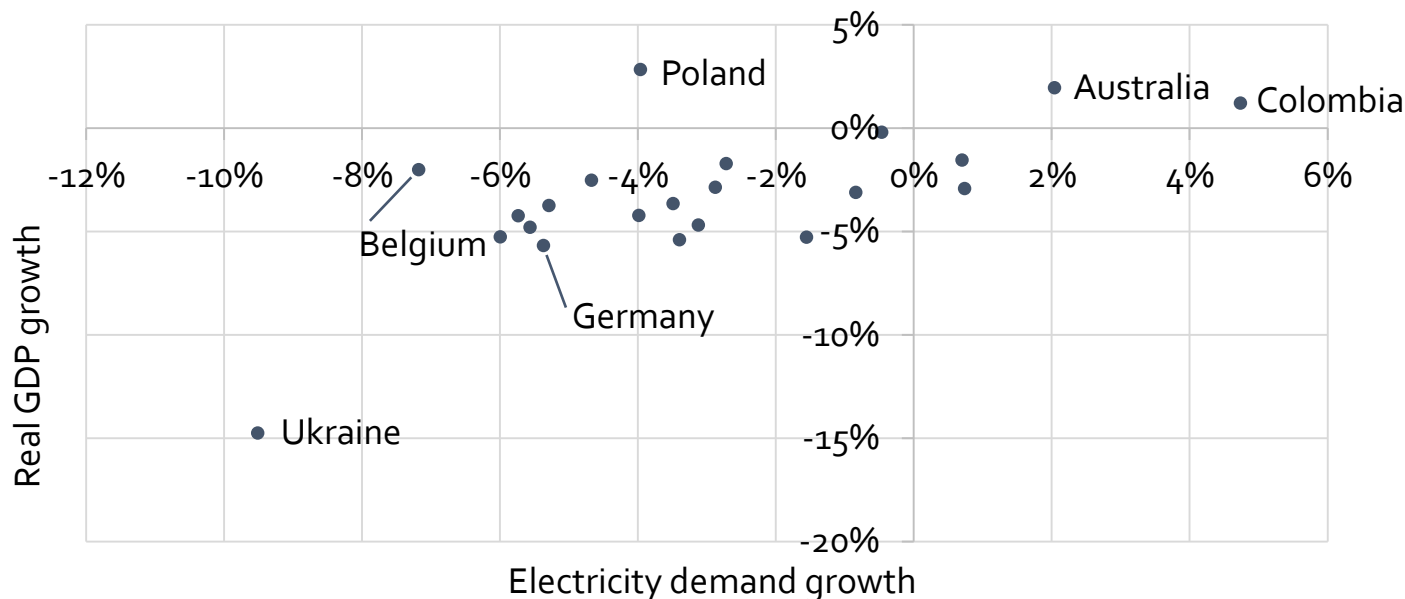


Source: IMF (2020)

## Output growth is a key determinant for electricity demand

- Electricity demand is positively correlated with GDP growth
- During 2008/09 financial crisis electricity consumption has been significantly affected by economic shock

Real GDP and electricity demand growth for selected OECD countries and Ukraine, 2009

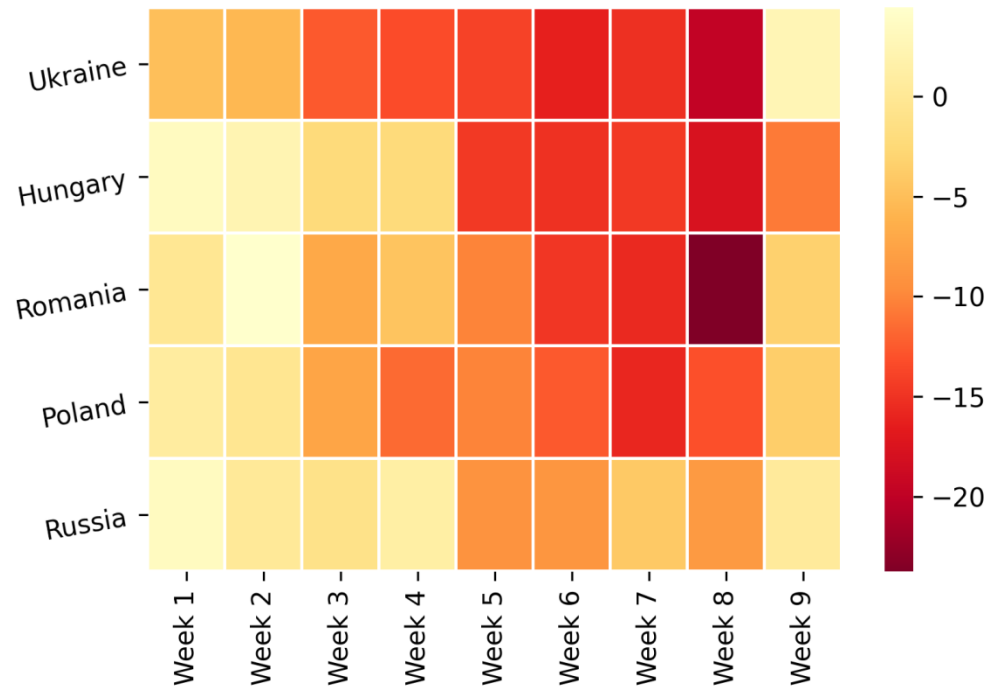


Source: enerdata.net; data.worldbank.org

## Ukraine's electricity consumption slumped in Mar' and Apr'20

- Starting mid-March, electricity consumption contracted up to -20% compared to same week in 2019
- Relative decrease coincides with introduction of quarantine measures
- In theory, higher temperatures could explain lower demand for (heating) electricity
- But: Temperatures during quarantine were on average actually slightly lower than 2019

Weekly electricity consumption as % change from 2019\*



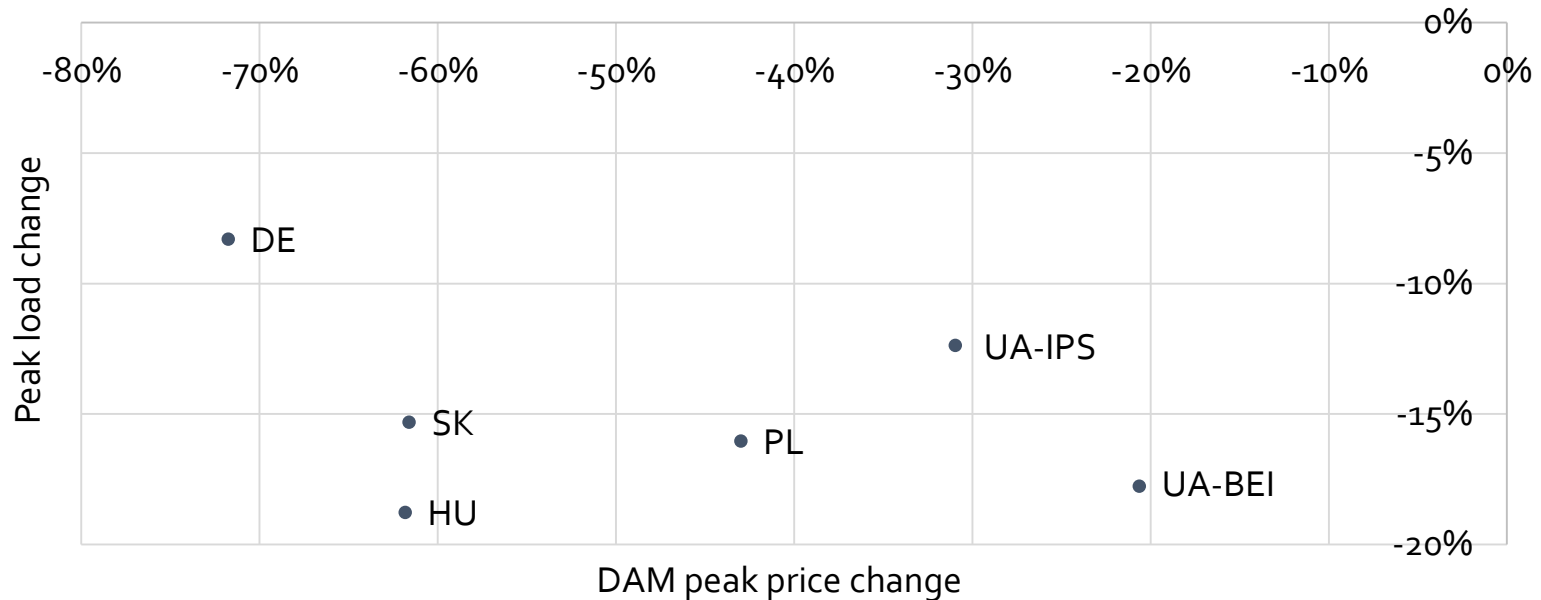
\*Week 1 is 2-6 March 2020, compared to 4-8 March 2019

Source: Bruegel

## The effects of lower demand on wholesale prices

- In neighbouring EU countries as well as in Germany, negative demand shock has led to lower electricity wholesale prices in April 2020
- In Ukraine, day-ahead market (DAM) peak prices were less affected – especially in Burshtyn Island zone

**Peak load and DAM peak prices, 6-months relative change  
(Apr '20 vs Oct '19)**

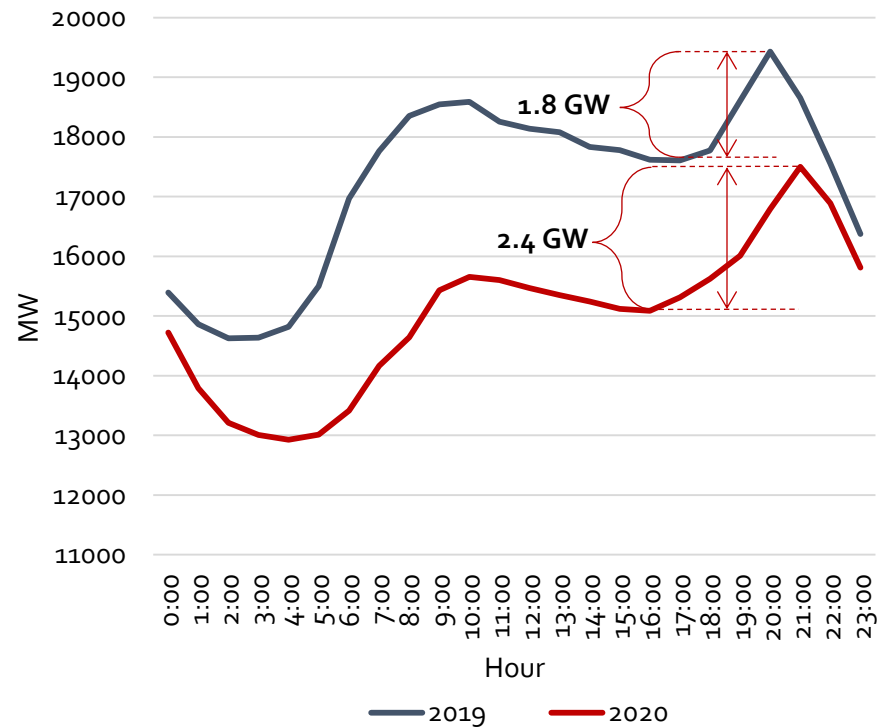


Source: ENTSO-e transparency platform, UA Market Operator data

## The effects of quarantine on load profiles and flexibility needs

- Industrial and commercial consumption decreases with idle production and businesses
  - As industrial demand profile is “flat”, total load profile is shifted downwards
- But: residential consumption increases as people spend more time at home
  - Residential load profile – characterised by strong evening demand – has higher share in total load
- Lower overall level and more pronounced evening peak in April 2020
- Larger afternoon ramp-up by thermal and hydro plants is needed

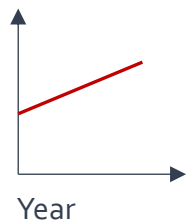
Average hourly load for April 2019 and April 2020 weekdays



Source: ENTSO-e transparency platform

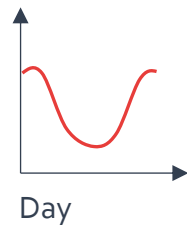
## Forecasting 2020 electricity consumption: Methodology

- We developed an econometric and time series model to forecast long-, medium- and short-term characteristics of electricity consumption
- Here we only forecast long-term, GDP-influenced level of consumption



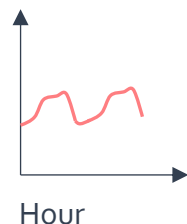
### Long-term model:

Captures yearly fluctuations in demand, based on economic and demographic variables



### Medium-term model:

Captures intra-year fluctuations on a daily basis, based on temperature, calendar variables and a stochastic component



### Short-term model:

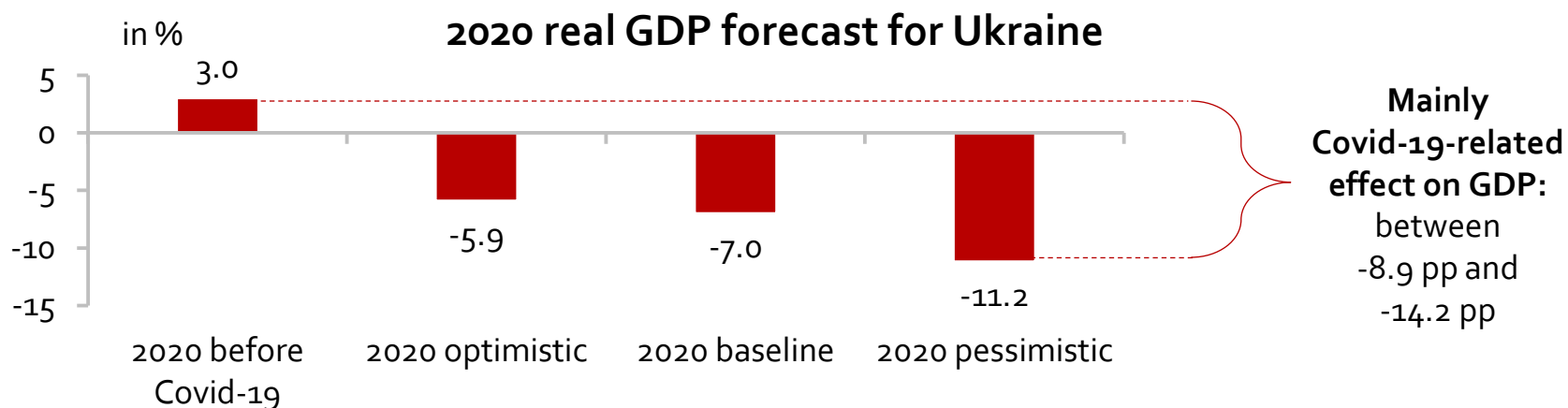
Captures intra-day fluctuations on an hourly basis, based on calendar variables and a stochastic component

Electricity Demand Model



## Key inputs and assumptions

- We use 2020 GDP forecast by German Economic Team (GET) Ukraine as an input for our electricity demand model
- GET Ukraine estimates COVID-19 impact on Ukraine via two channels
  - Impact of domestic measures
  - Impact of external shocks
- Main factors for 2020 downturn: Private consumption and investments, with the stronger decline in investments



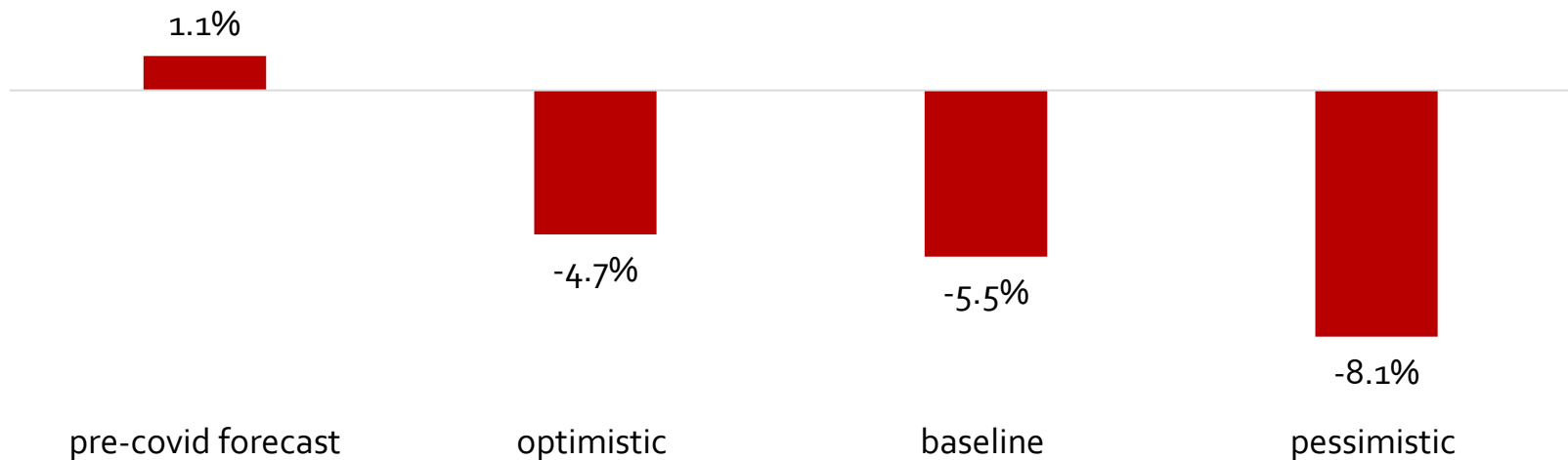
Source: IER, GET Ukraine

## Forecasting 2020 electricity consumption: Results

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- In baseline scenario of 7% GDP decline, electricity consumption contracts by **5.5%** in 2020
  - In optimistic and pessimistic scenarios, contraction is estimated between 4.7% and 8.1%
- Even if GDP grows again by 3-4% p.a. in 2021 and 2022, electricity demand likely to remain below 2019 levels at least until 2022

### Electricity demand scenarios for 2020



Source: IER, GET Ukraine, own calculations

## Conclusion

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- Recession induced by COVID-19 crisis will significantly affect 2020 electricity demand in Ukraine
- Electricity consumption unlikely to recover 2019 level until 2022
- Further analysis should address the following questions:
  - What explains the relatively modest reaction of wholesale prices in Ukraine during the crisis?
  - How could the demand decline – together with the projected increase in renewable generation – alter the fuel mix of electricity generation in Ukraine?

## Limitations

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- Model takes economic factors into account on an annual basis , demand slump during quarantine months likely to be higher
- Restricting the econometric model to two independent variables (GDP and population) simplifies forecasting but neglects the influence of technological factors on electricity demand



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## Annex

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- Long-term model:

$$\hat{D}_L = \beta_{L,1} + \beta_{L,2}POP + \beta_{L,3}GDP$$

- Model is fitted with annual real GDP data and average annual population data from 2001-2019
- Model performance metrics:
  - Mean Absolute Percentage Error (MAPE): 3.14%
  - Root Mean Square Error (RMSE): 700 MW