National Technical University of Athens (NTUA)

NEURAL INFORMATION PROCESSING SYSTEMS

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Climate Change AI

NeurIPS 2020 Workshop: ***Tackling Climate Change with Machine Learning***

A Generative Adversarial Gated Recurrent Network for Power Disaggregation & Consumption Awareness

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OUTLINE

- ✓ Motivation and relation to climate change
- ✓ Non-intrusive load modeling (NILM) fundamentals
- ✓ Limitations of the existing NILM methods
- ✓ The proposed EnerGAN++ model
- ✓ Results

THE PROBLEM OF ENERGY CONSUMPTION AWARENESS

Common truth:

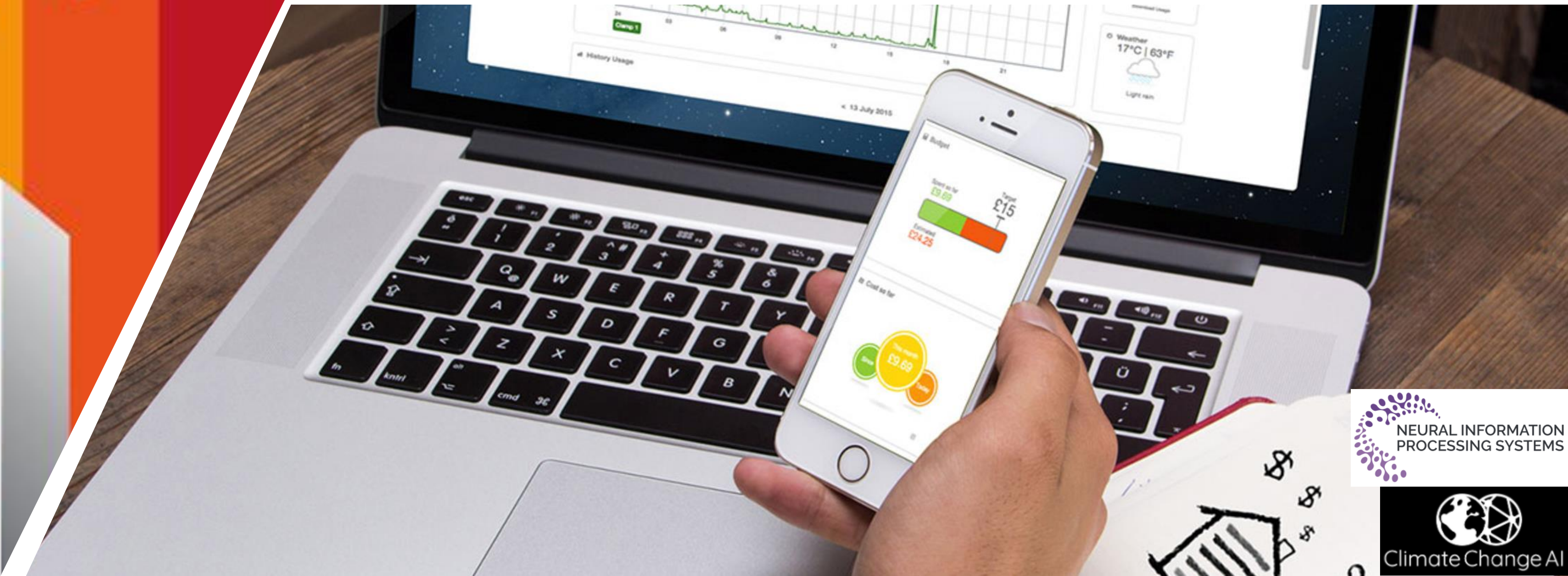
Consumers need to become aware of their energy consumption

Gap:

However, consumers often lack knowledge about potential energy savings, existing policy measures and relevant technologies

Problem:

Nonetheless, the information about energy consumption is not translated into good practices and tailored advice for energy saving.



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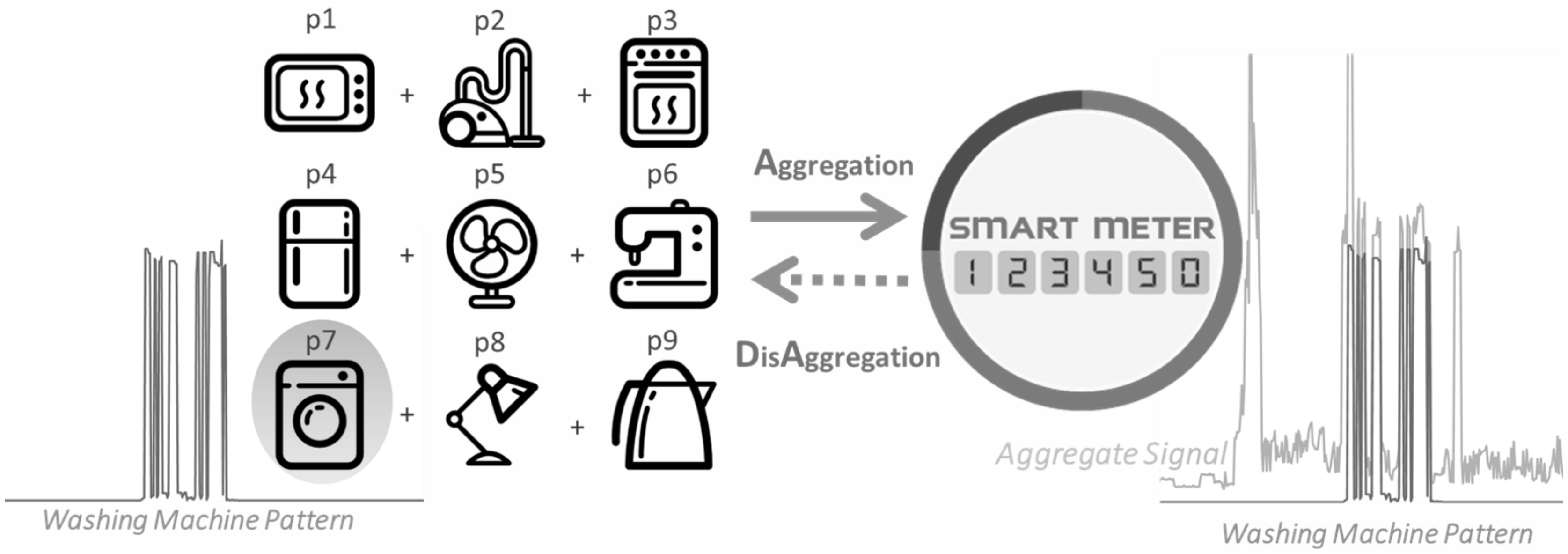
THE SOLUTION: NILM



Non-Intrusive Load Monitoring (NILM), or **Energy Disaggregation** *(Hart, 1992)* is known as the determination of appliance-specific load consumption, using the aggregate power signal of a household as input.

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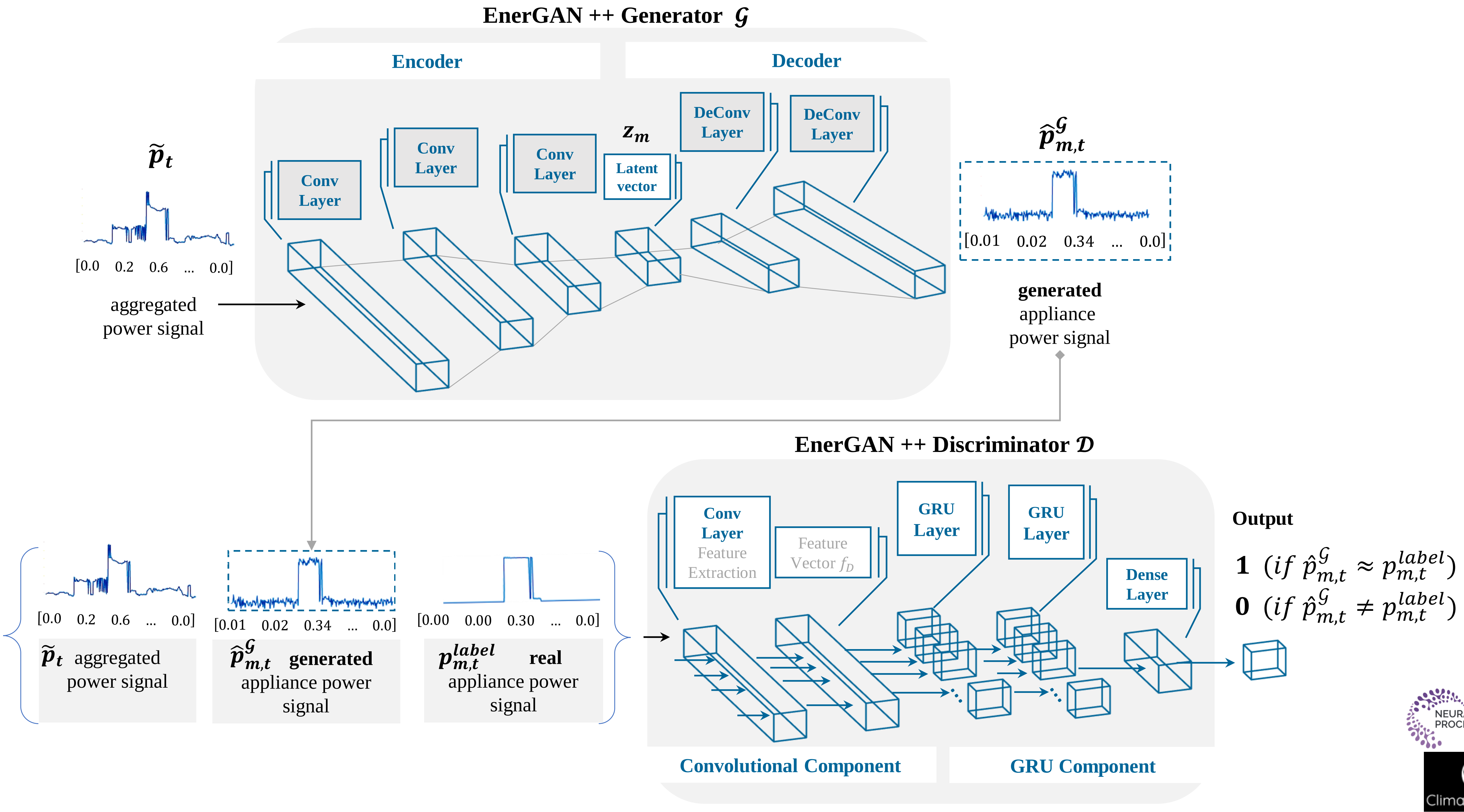
OUR SOLUTION: EnerGAN++ MODEL



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PERFORMANCE EVALUATION AND COMPARISONS

- ***Datasets:*** AMPds and REFIT
- ***Metrics:***

generated appliance power signal

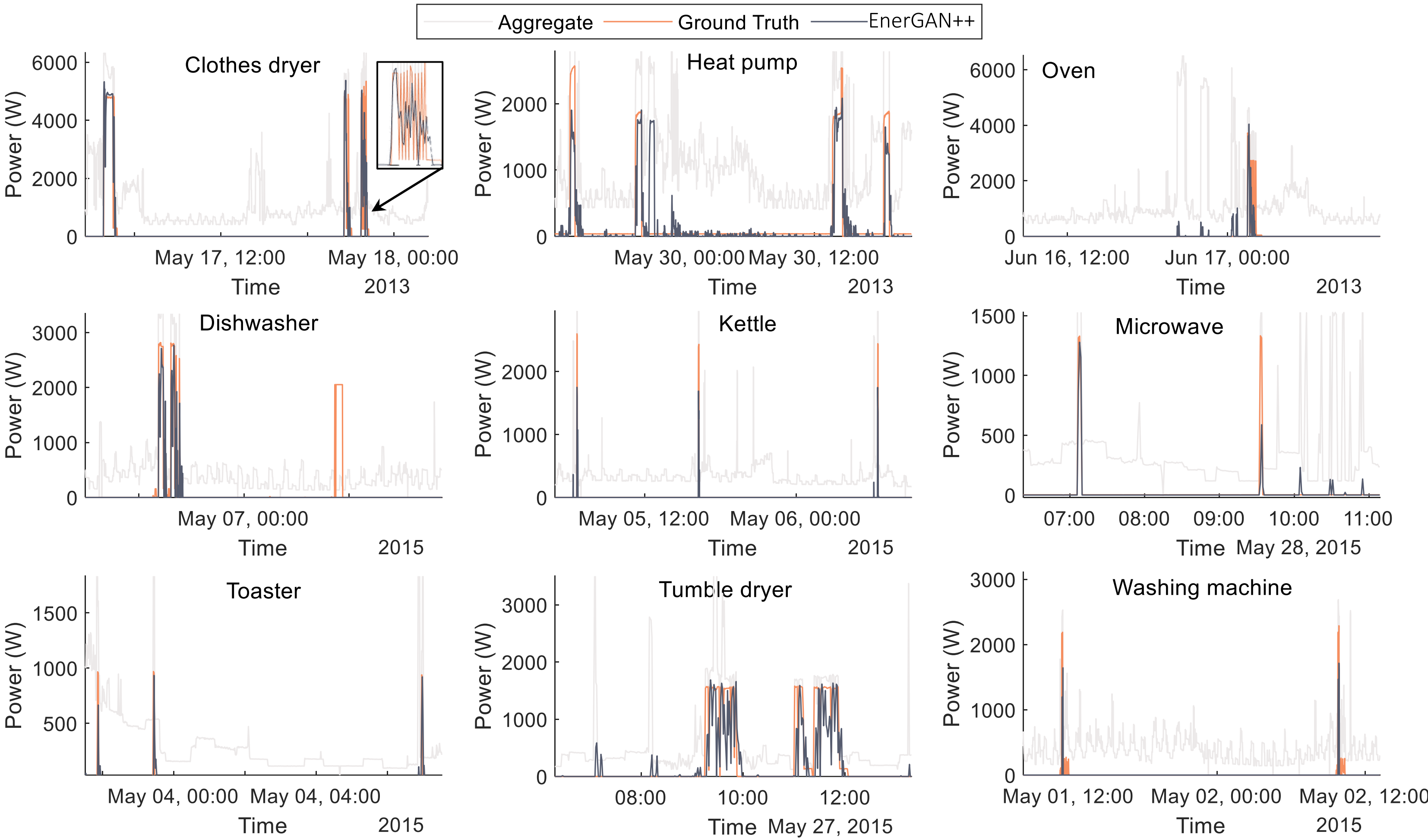
real appliance power signal

$$MAE = \frac{\sum_{t=1}^{T} \left| \hat{p}_{m,t} - p_{m,t} \right|}{T}$$

appliance operation duration

- ***Comparisons:***
  (i) Long Short-Term Memory method (*Kaselimi, 2019b, 2020*),
  (ii) Denoising Autoencoders (DAE) (*Kelly, 2015*),
  (iii) seq2seq CNN (*Chen, 2018*),
  (iv) Combinatorial Optimization (CO) (*Batra, 2014*) and
  (v) Factorial Hidden Markov Model (FHMM) (*Batra, 2014*).

RESULTS



	Wash. Dr.	H. Pump	Oven	Dish	Kettle	Micro	Toast	Tum. Dr.	Wash
Proposed	17.7	**80.1**	**8.1**	**20.3**	**7.8**	**8.3**	**2.2**	**16.9**	**7.3**
BabiLSTM	**10.0**	88.2	17.6	29.2	41.2	15.2	12.8	48.7	17.6
DAE	37.3	55.6	19.2	25.4	9.1	12.2	8.3	32.9	13.4
seq2seq CNN	15.4	107.1	67.5	34.9	19.8	14.8	15.0	42.5	27.0
LSTM	90.2	154.9	57.6	102.1	41.1	15.9	26.7	87.8	31.8
FHMM	129.5	121.6	49.3	147.7	40.8	77.3	32.4	91.5	177.0
CO	120.1	249.3	267.1	138.8	40.6	51.8	35.6	91.9	210.9

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Thank you!

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