Transitions Pathways and Risk Analysis for Climate Change Mitigation and Adaptation Strategies

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

Development of the Greek solar market towards decentralized renewable energy generation and storage

Assoc. Professor Dr. Alexandros Flamos

Director of Technoeconomics of Energy Systems Laboratory (TEESlab)
Dept. of Industrial Management & Technology, University of Piraeus (UNIPI)
Editor in Chief at Energy Sources, Part B: Economics, Planning, and Policy

Set-Nav Regional & TRANSrisk Workshop

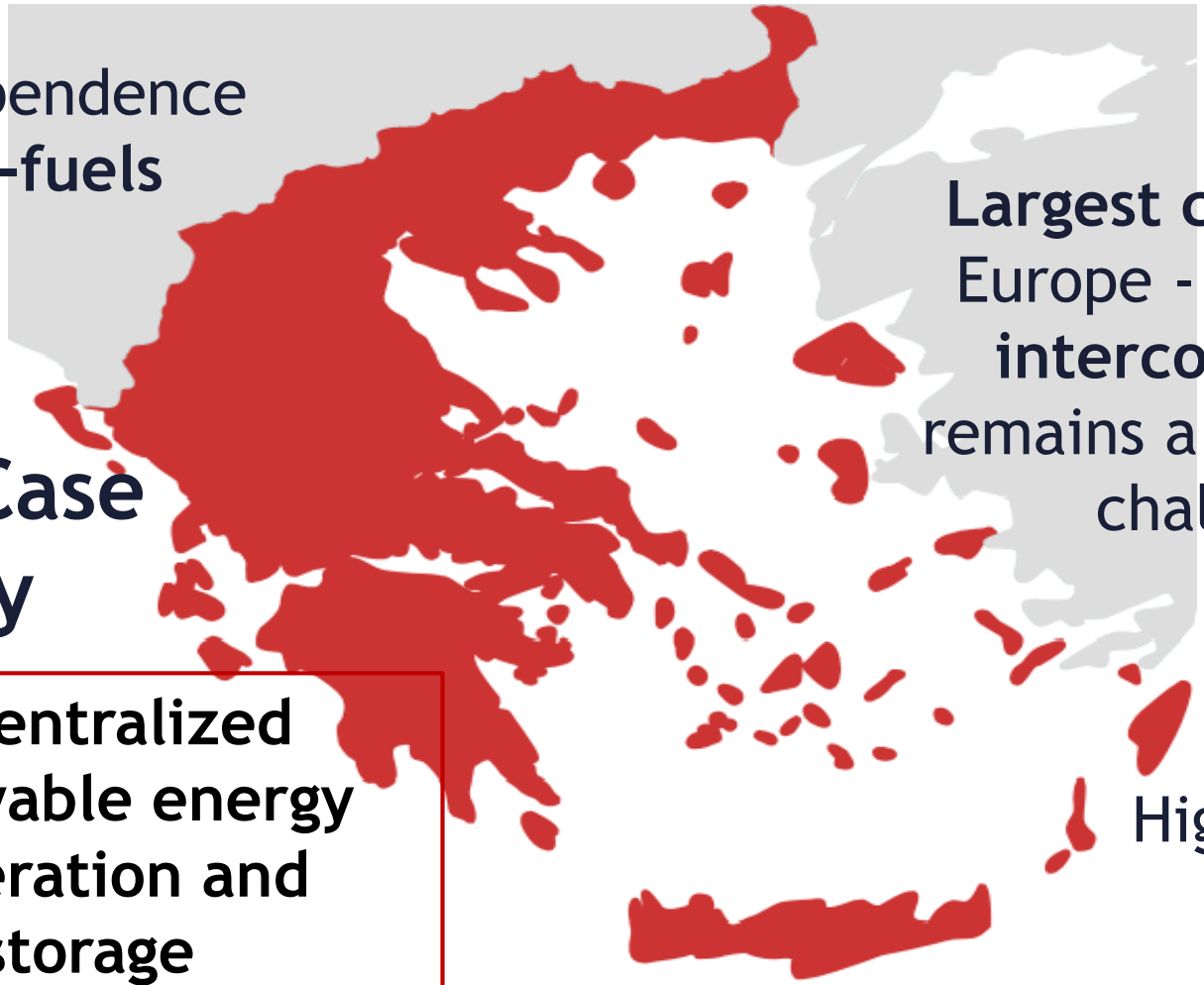
Athens, 16th November

SET-Nav
Strategic Energy Roadmap

TRANSRISK - CASE STUDY: GREECE

High dependence on **fossil-fuels**

Largest coastline in Europe - electricity **interconnection** remains a **continuous** challenge



Greek Case Study

Decentralized renewable energy generation and storage

High potential in **RES-E**

TEESlab University of Piraeus Research Center

DECENTRALIZED FUTURE OF THE GREEK POWER SYSTEM

challenges
- Technological
- Regulatory
- Economic
- Social

→ Reality

Realistic pathway towards a low carbon power system

Vision of consumers
- generating
- storing
- consuming
- Sharing clean energy

..at local level

MODELING TOOLS – TEEM SUITE

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

ATOM
Agent-based Technology Adoption Model

Agent-based **T**echnology ad**O**ption **M**odel

DREEM
Dynamic Demand-Response Simulation Model

Demand-**RE**spons**E** **M**odel

TEEM
High-resolution Energy System Simulation Models

Modeling **suite** to perform **quick simulations** as part of an **iterative participatory process** aiming to provide answers to **"what if"** scenarios

Adaptive pol**I**cy pathways **M**odel

AIM
Adaptive Policy Pathways Model

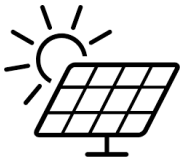
Wholesale Electricity Market Simulator

BSAM
Business Strategy Assessment Model

TEESlab
University of Piraeus Research Center

Further Deployment of Small-Scale PV – Background

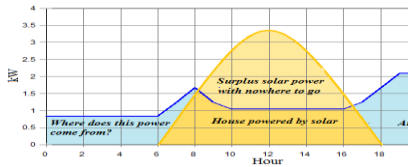
Small residential PV systems (i.e. 1kWp-10kWp) in **Greece** have gained the investors' attention, mainly due to the profitable **FiTs**.

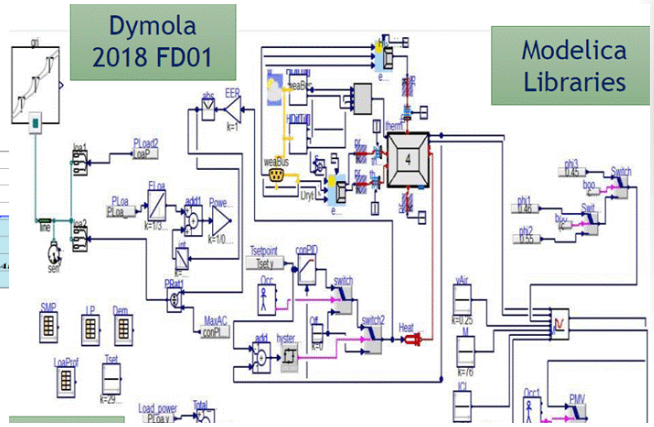


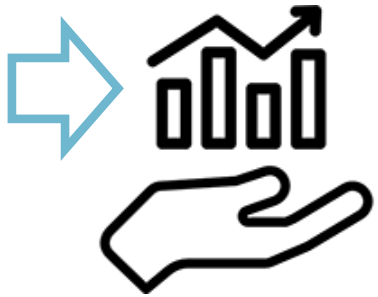
However: In 2013, due to the economic recession a drastic **reduction** of the **tariffs** and the imposition of a **retroactive levy** took place.

These retroactive **cuts** to the **FiTs prices** shook the **confidence** of investors in the **stability** of the expected **revenues**.

Further Deployment of Small-Scale PV – incentives





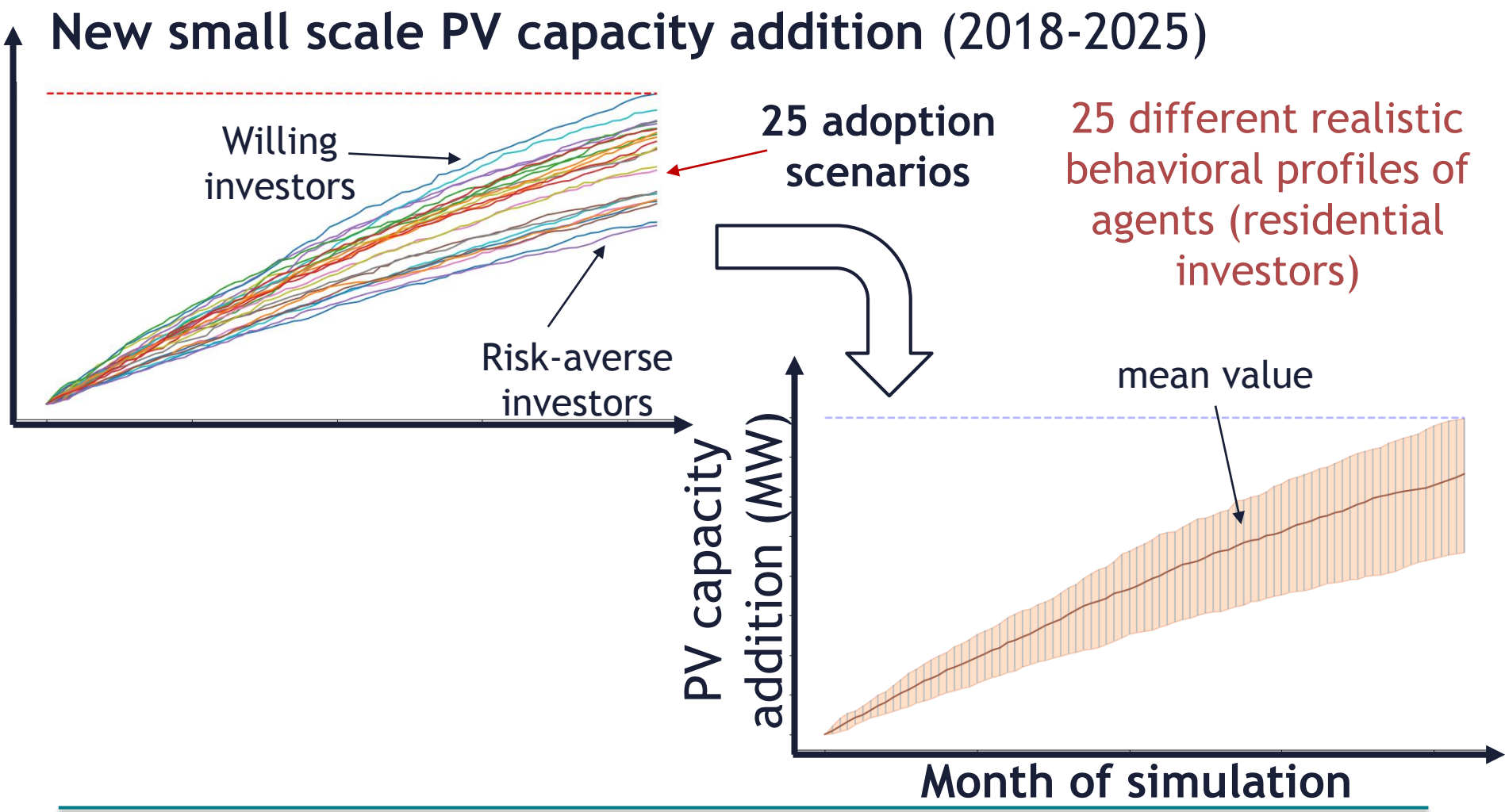


Net-Metering and **subsidy** of storage can **incentivize** the addition of new PV capacity. However, ….

… what **level of subsidy** will drive to the desirable outcome? …. residential investors have various profiles (**risk averse, willing**) and their behavior is affected by neighborhood … how uncertainty could be **quantified**?

TEESlab
University of Piraeus Research Center

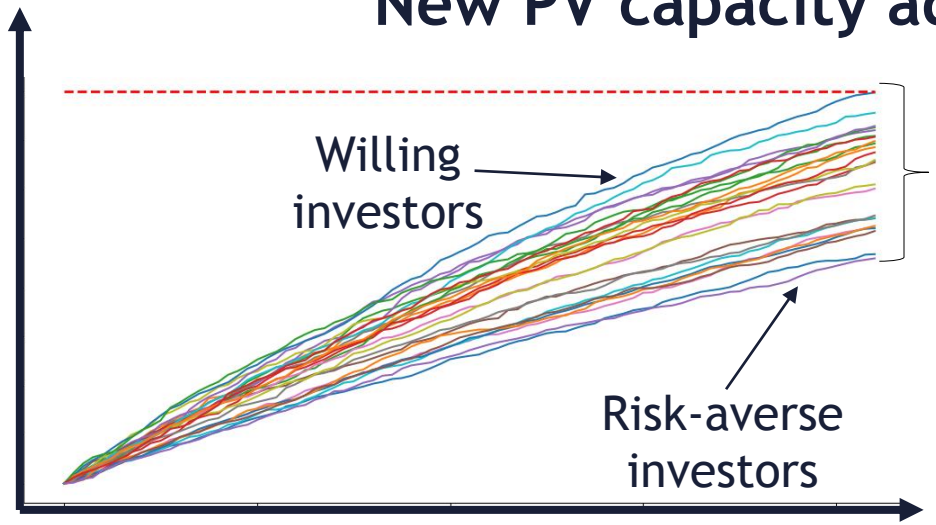
Further Deployment of Small-Scale PV – Example (1/2)



Further Deployment of Small-Scale PV – Example (2/2)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

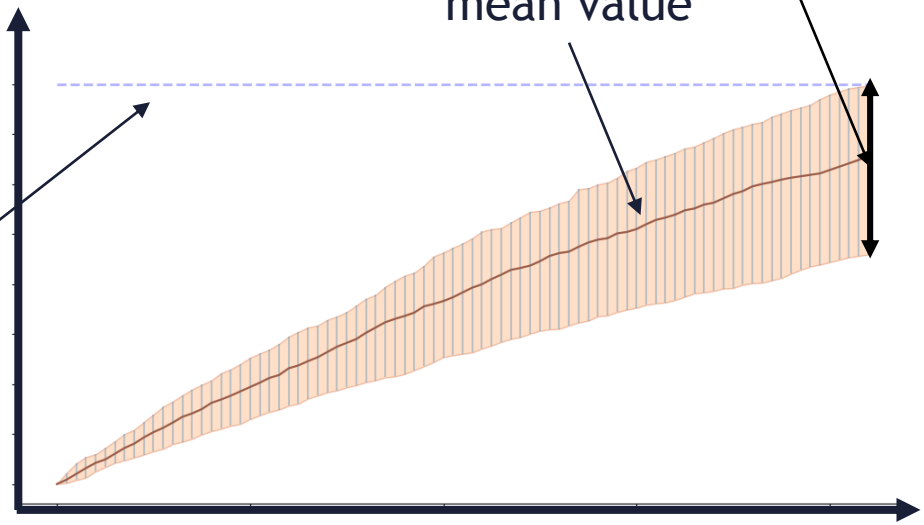
New PV capacity addition (2018-2025)



Quantifying adoption uncertainty

=

Variance of outcomes



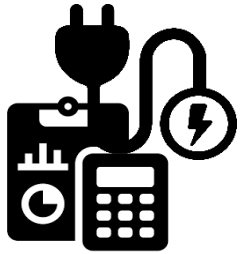
400 MW – Capacity achieved with Feed-in-Tariffs in Greece from 2010-2013

FURTHER DEPLOYMENT OF SMALL-SCALE PV IN GREECE (1/12)

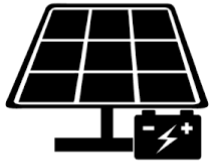
TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

"What if" we promote further deployment of **small-scale PV** in Greece, under :

⇨ **The current Net-Metering scheme**



⇨ **A storage subsidy of 30%**



With…

*…**No changes** in the current retail price*

TEESlab
University of Piraeus Research Center

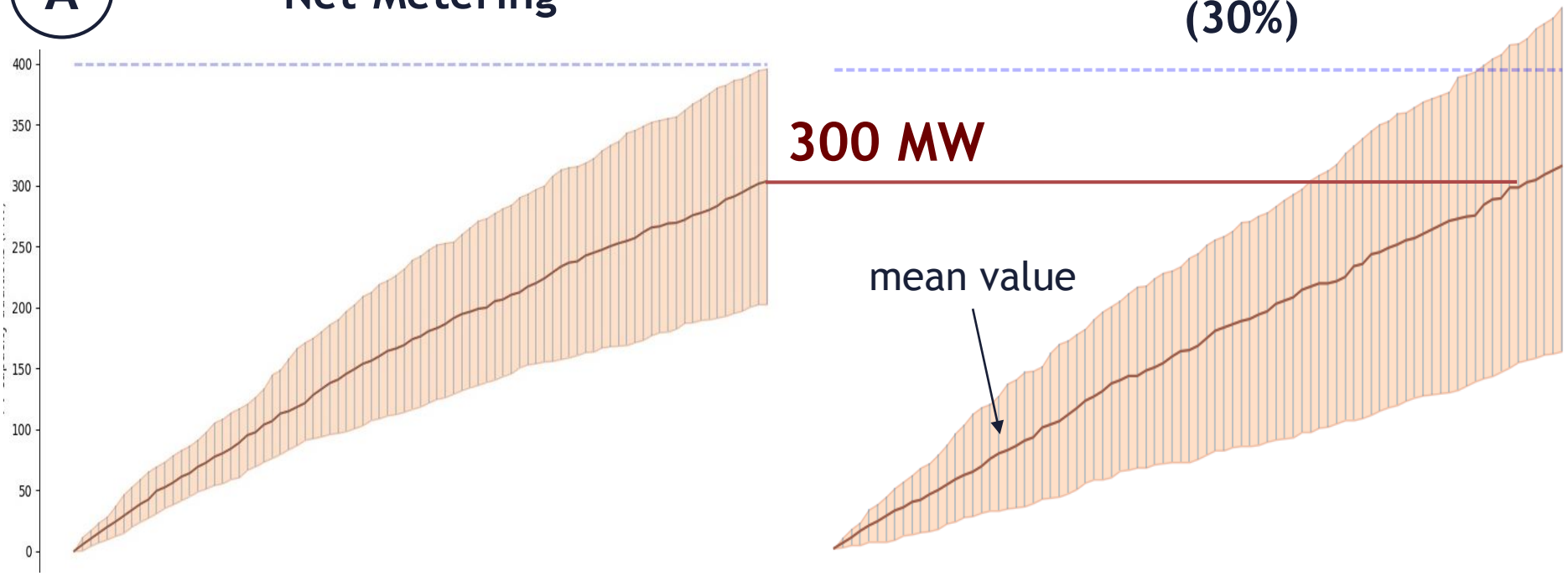
Further Deployment of Small-Scale PV in Greece (2/12)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

A

Net-Metering

Subsidising storage (30%)



In average, subsidizing storage (**30%**) seems almost **equally effective** with the current Net-Metering.

TEESlab
University of Piraeus Research Center

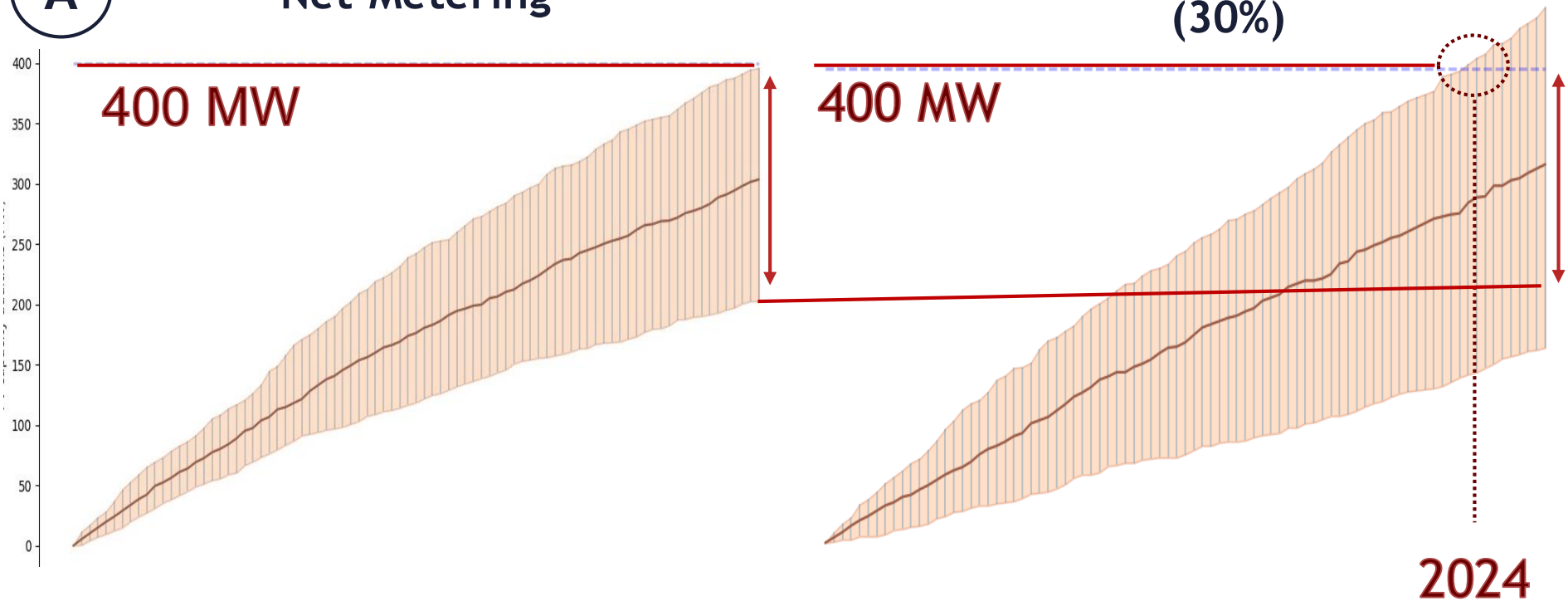
Further Deployment of Small-Scale PV in Greece (3/12)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

A

Net-Metering

Subsidising storage (30%)



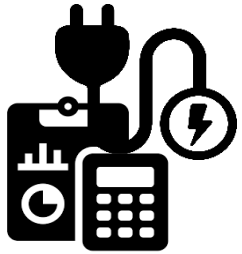
However, variance is much bigger in the case of **30% subsidy of storage - implying a much higher uncertainty on the agents side.**

FURTHER DEPLOYMENT OF SMALL-SCALE PV IN GREECE (4/12)

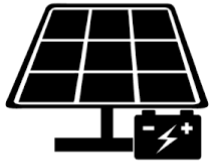
TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

"What if" we promote further deployment of **small-scale PV** in Greece, under :

⇨ **The current Net-Metering scheme**



⇨ **A storage subsidy of 30%**



With…

*…**8.5% annual increase** in the current retail price*

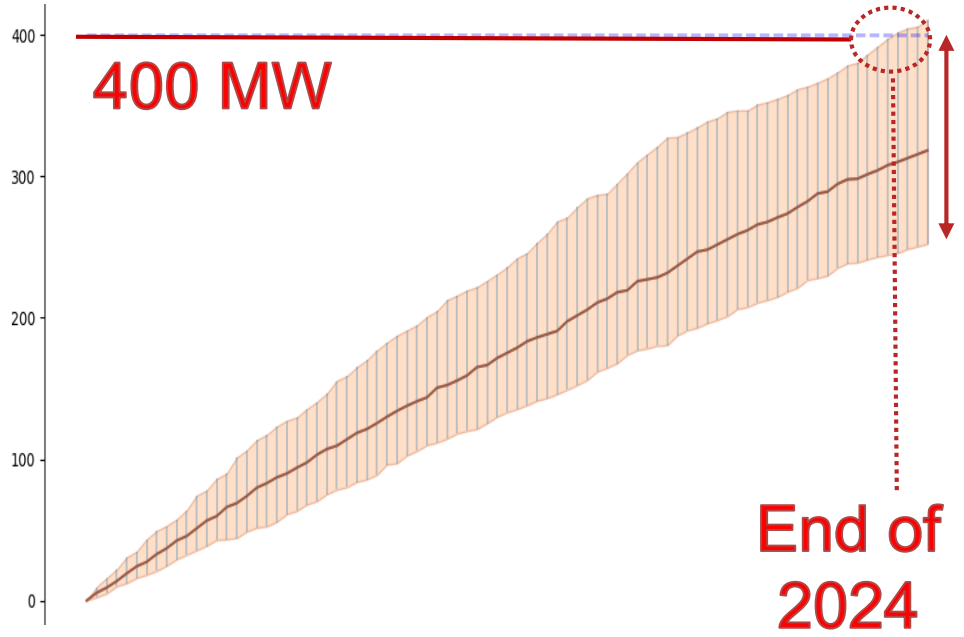
TEESlab
University of Piraeus Research Center

Further Deployment of Small-Scale PV in Greece (5/12)

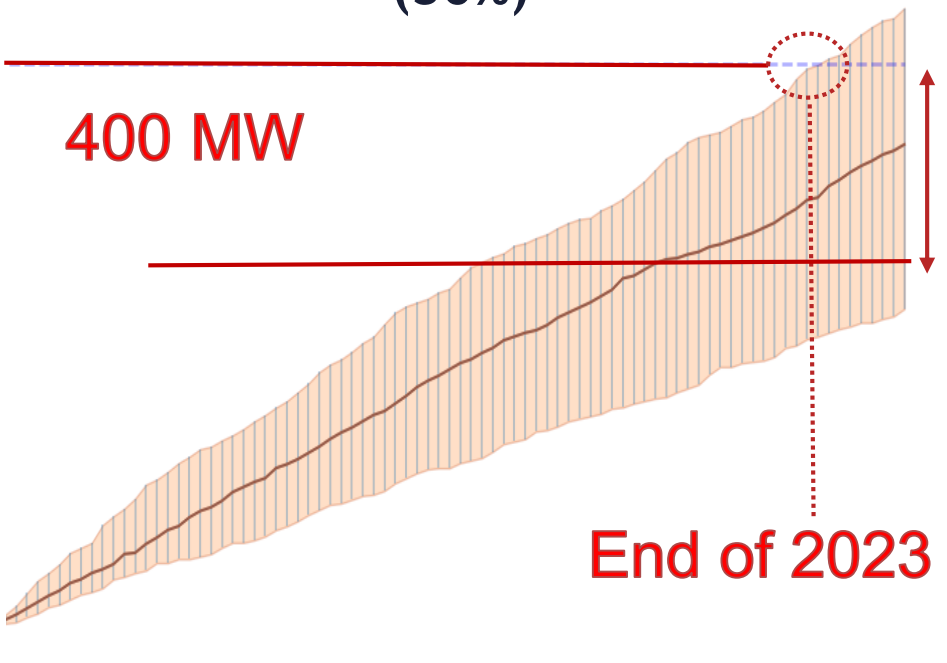
TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

B

Net-Metering



Subsidising storage (30%)



Subsidising storage (30%) presents similar **effectiveness** to the current **Net-Metering**

TEESlab
University of Piraeus Research Center

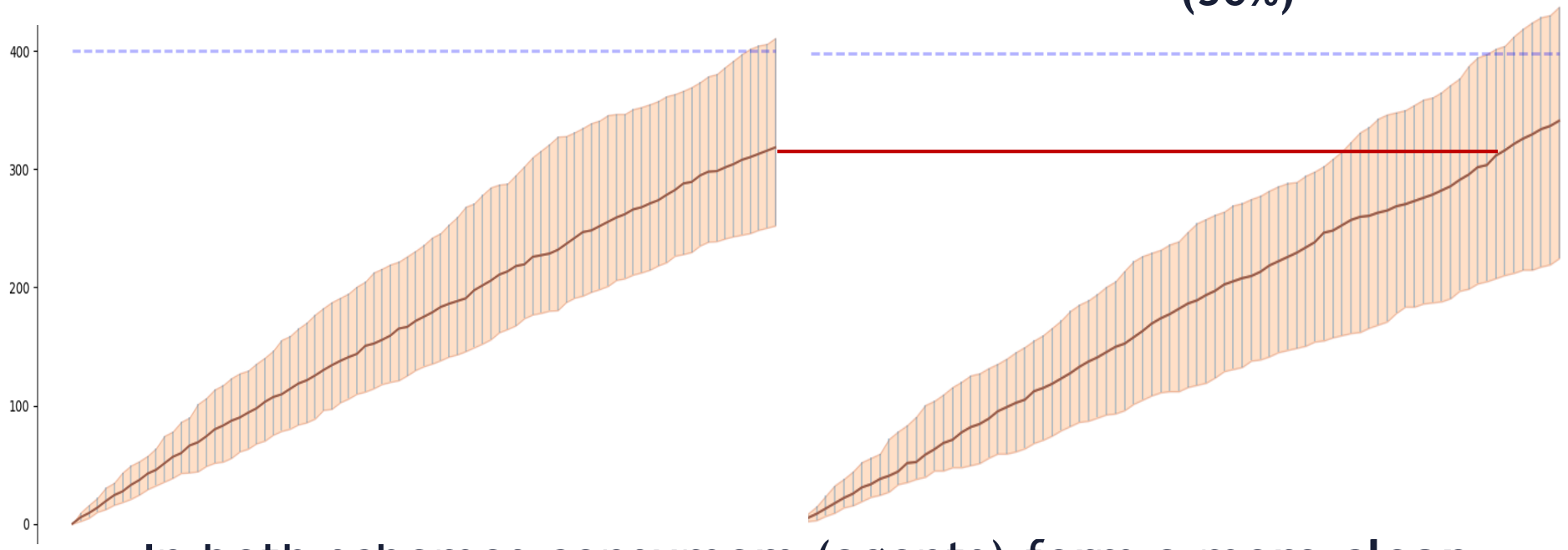
Further Deployment of Small-Scale PV in Greece (6/12)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

B

Net-Metering

Subsidising storage (30%)



In both schemes consumers (agents) form a more **clear perception** of investment **profitability** & the variance is significantly reduced

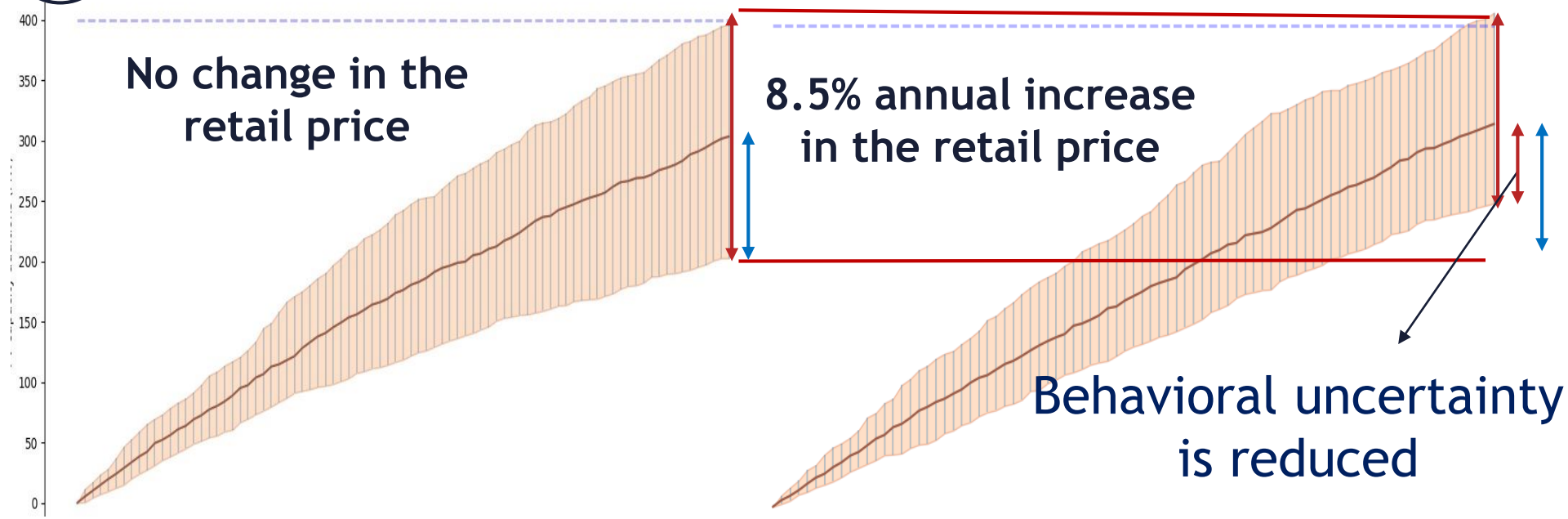
TEESlab
University of Piraeus Research Center

Further Deployment of Small-Scale PV in Greece (7/12)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

B

Net-Metering



The increase of retail price **mainly affects the perception of risk averse investors** → they recognize the **increased benefits for "prosumers"**

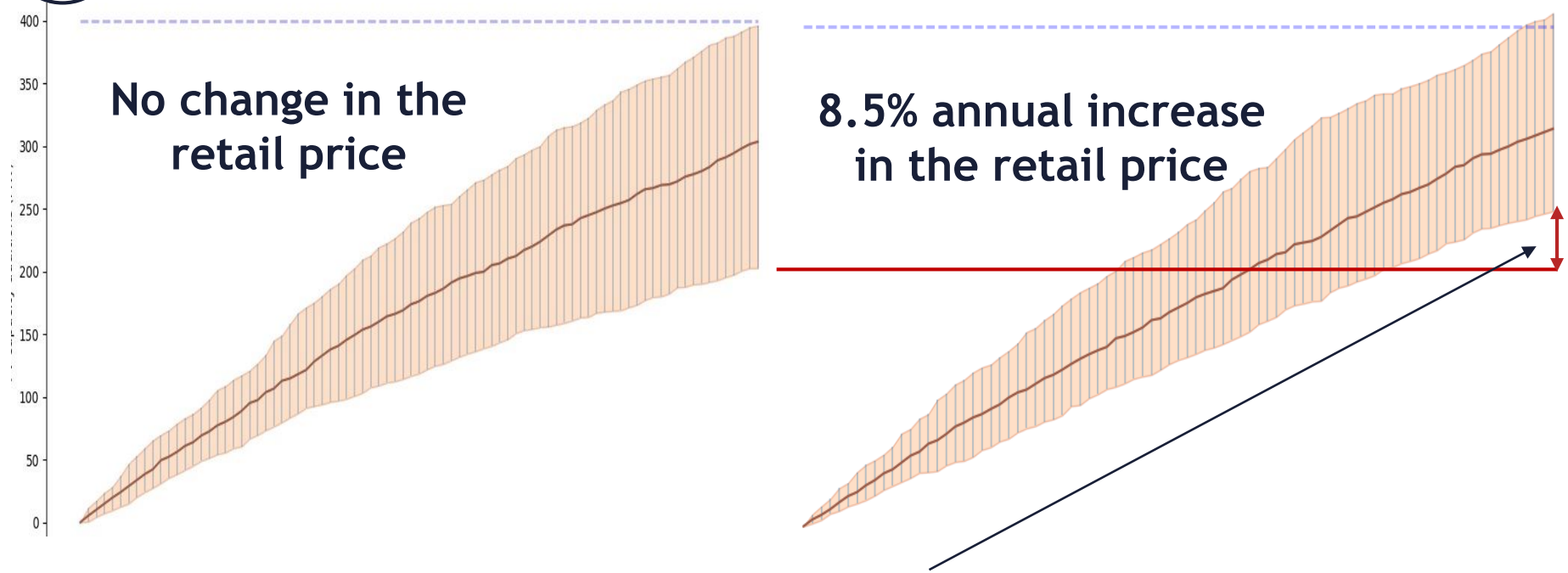
TEESlab
University of Piraeus Research Center

Further Deployment of Small-Scale PV in Greece (8/12)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

B

Net-Metering



….since they gain a **more explicit perception** of the **profitability** of the scheme over the years

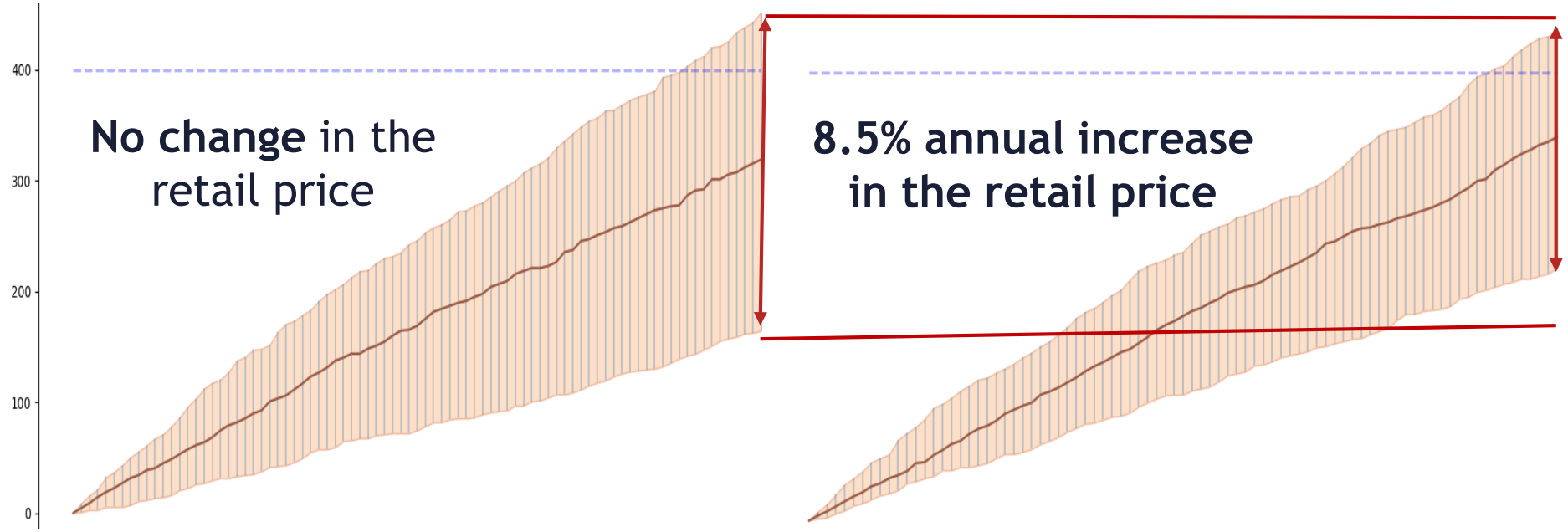
TEESlab
University of Piraeus Research Center

Further Deployment of Small-Scale PV in Greece (9/12)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

B

Subsidising storage (30%)



….the same applies for the case of the 30% storage subsidy scheme

TEESlab
University of Piraeus Research Center

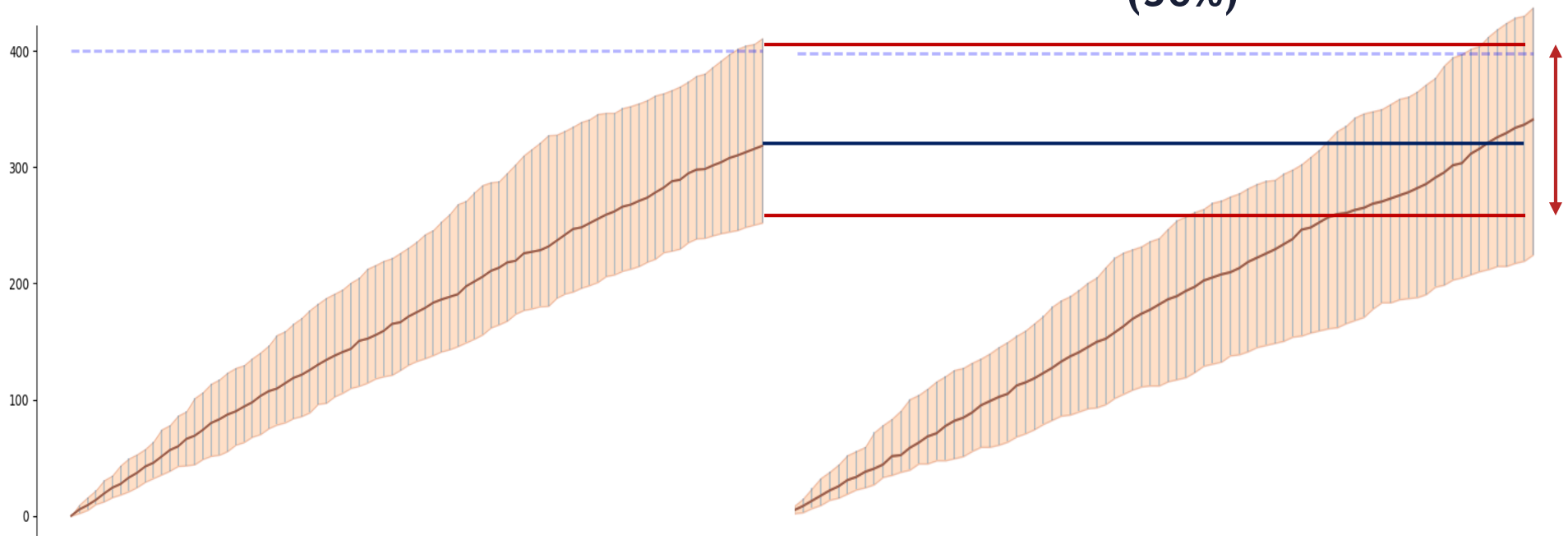
Further Deployment of Small-Scale PV in Greece (10/12)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

B

Net-Metering

Subsidising storage (30%)



Subsidising storage (30%) presents similar effectiveness – however, higher variance of outcomes than **Net-Metering**

Further Deployment of Small-Scale PV in Greece (11/12)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

… *"What if"* we promote further deployment of **small-scale PV** in Greece, under :

a storage subsidy of 50% ???

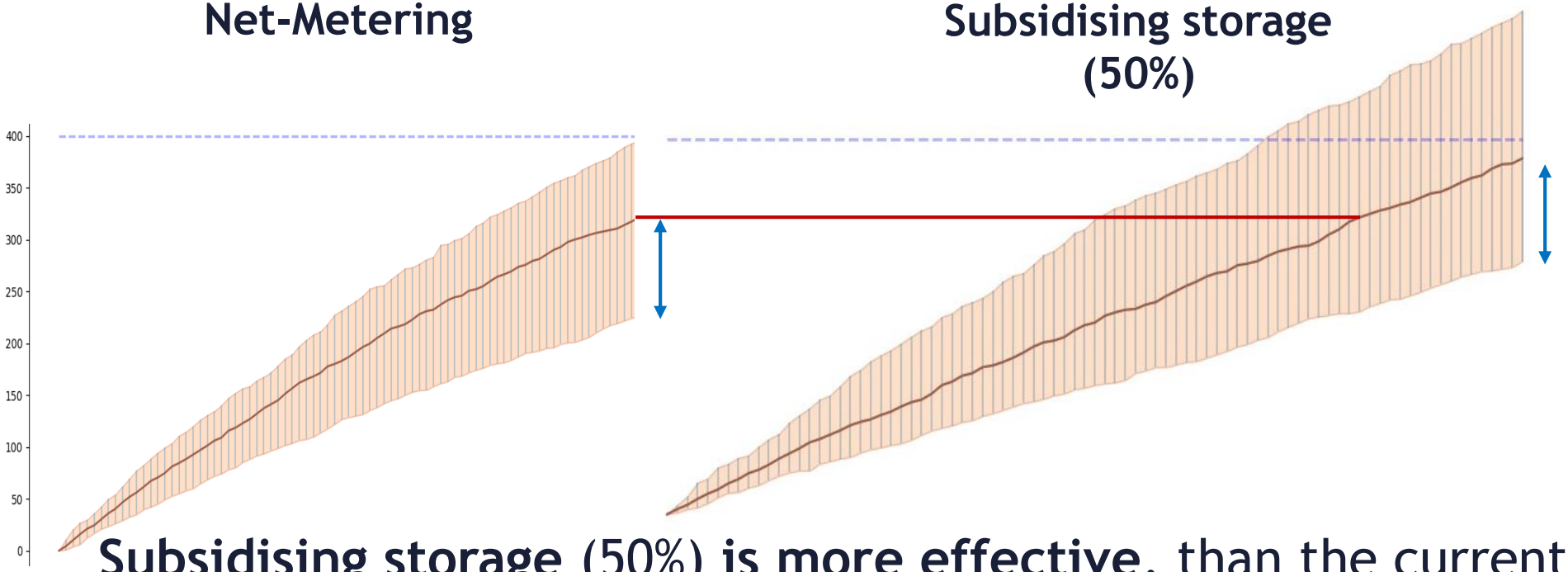
Further Deployment of Small-Scale PV in Greece (12/12)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

C

Net-Metering

Subsidising storage (50%)



Subsidising storage (50%) **is more effective**, than the current **Net-Metering** and variance of risk averse agents' scenarios is **low** - indicating the **clear perception of profitability.**

TEESlab
University of Piraeus Research Center

Need for Adaptive Policy Pathways…(1/3)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

So …

… What should we do ???

Especially striving towards National RES Targets of 2030 & 2050

NEED FOR ADAPTIVE POLICY PATHWAYS… (2/3)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

Taking into account uncertainty…

Need for Adaptive Policy Pathways…

…incorporating multiple stakeholders' perspectives into modelling scenarios

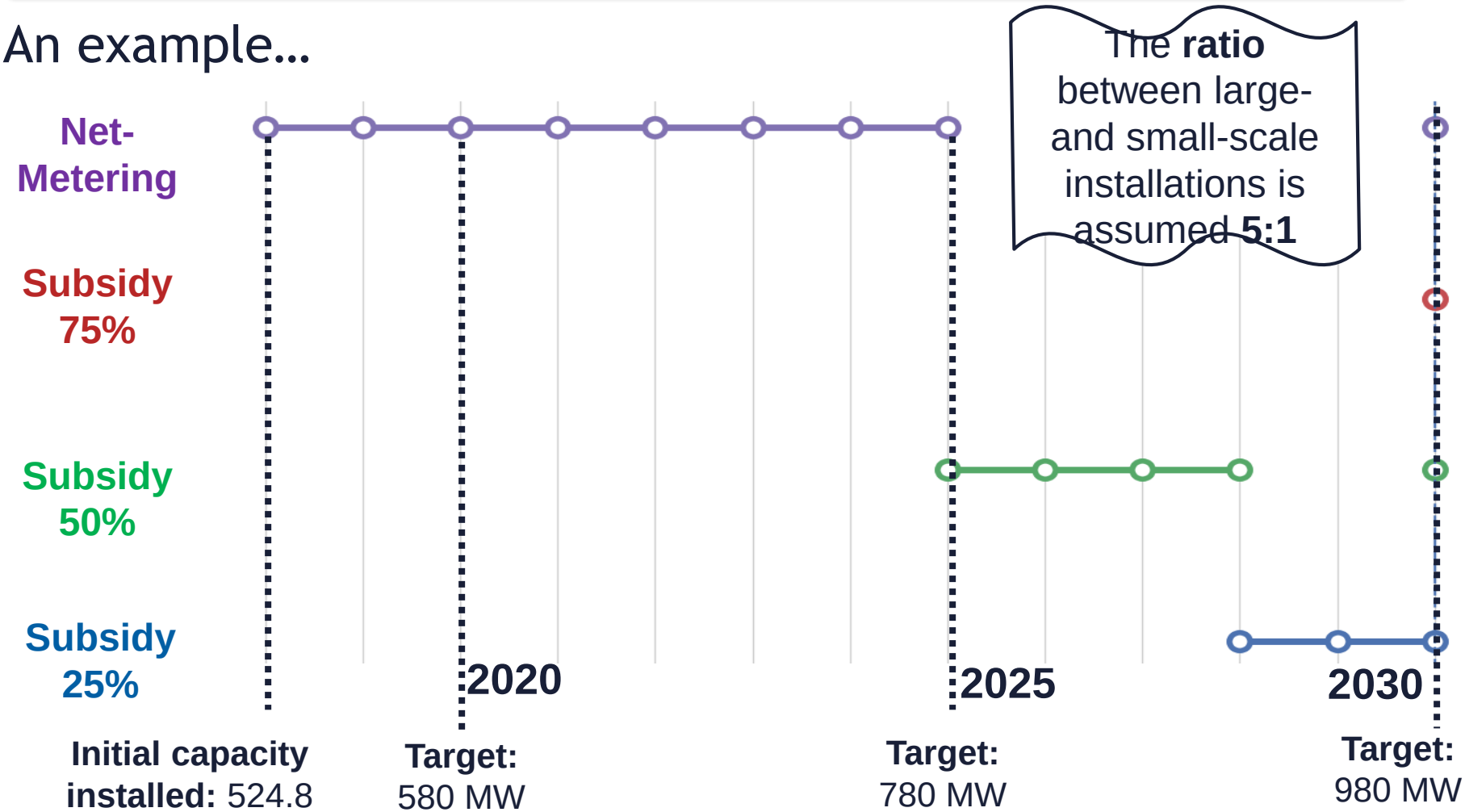
…visualizing policy adaptation maps, showing alternative pathways leading to desired policy outcomes

TEESlab
University of Piraeus Research Center

Need for Adaptive Policy Pathways… (3/3)

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

An example…



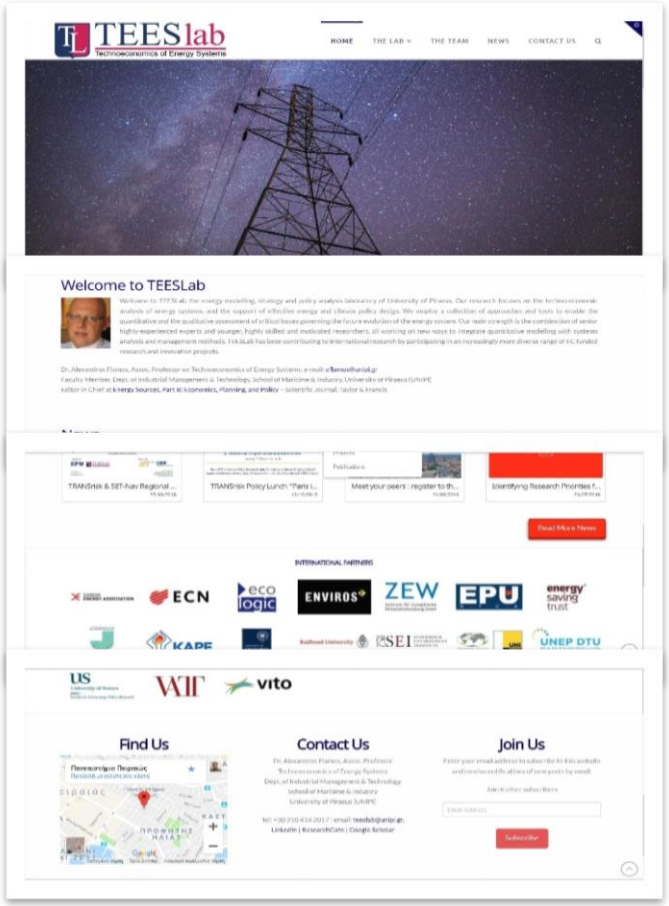
TEESlab
University of Piraeus Research Center

FOR MORE INFORMATION…

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

TEESLab, the energy modelling, strategy and policy analysis laboratory of **University of Piraeus** (UNIPI).

Find more about us..



Visit our Website:
https://teeslab.unipi.gr/

Contact us by e-mail:
teeslab@unipi.gr

Find us in LinkedIn:
www.linkedin.com/groups/12070918/

TEESlab
University of Piraeus Research Center

TEESlab
University of Piraeus Research Center

TRANSrisk
TRANSITION PATHWAYS AND RISK ANALYSIS FOR CLIMATE CHANGE POLICIES

Vassilis Stavrakas, vasta@unipi.gr

Serafeim Michas, michas@unipi.gr

Niki-Artemis Spyridaki, nartemis@unipi.gr

Chara Karakosta, chakara@unipi.gr

Sotiris Papadelis, sotpapa@unipi.gr

Alexandros Flamos, aflamos@unipi.gr

It's all about TEEM*work !*