

## Improving the electricity sector planning in TIMES in view of large scale RES penetration

IEW 2013, June  
Paris

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### The TIMES model

TIMES model is not able to consider in detail the various non-linear aspects of a power system

It includes a rather elementary approach for dispatching, transmission and non dispatchable RES generation

As a result, the optimal technology mix computed by TIMES may not be optimal

## Methodology Issues

To obtain an **accurate least cost solution for RES penetration**

it is necessary to develop

**databases with regional RES potential**

which will be connected to the TIMES model describing areas with **classes of the same RES technology with different costs**

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## Methodology Issues

TIMES model solution will then prioritize different classes of RES investments according to

their real cost which would incorporate

- balancing units and storage units costs
- grid expansion and connection costs
- utilization factors of RES in specific areas

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## Methodology Issues

- A number of efforts were recently conducted towards incorporating DC power flow analysis into TIMES as well as towards the incorporation of the so called Residual Load Duration Curves
- Several additional tasks are required however, in order evaluate these methodologies which are recently integrated
- Such an effort should include the development of several test cases, to define an appropriate simulation based on an increased number of time slices, that would evaluate the effectiveness of the methodology for accurate calculations regarding RES penetration in electricity
- This task will include development of a sufficient number of test cases related to real cases of increased RES penetration
- Such an evaluation of the models will lead to all the necessary modifications of the recently developed methodologies and the relevant software modifications into TIMES

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## Deliverables

A report with

a detailed description on setting up the case studies (which can be used as a manual for the new features in TIMES) and

a comparison on the results obtained with results obtained from more detailed electricity models

Time schedule: 12 months

Estimated Costs: 15000

Expected Benefits for ETSAP: A detailed analysis of how to model large renewable energy penetration in the electricity system using the new features of TIMES.

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