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Introduction to the power sector baseline scenarios and the IRENA SPLAT-W/MESSAGE tool

International Renewable Energy Agency (IRENA) Innovation and Technology Centre

Development of the ECOWAS RE and EF National Action Plans and SE4ALL
Abidjan, 17-19 March 2014

RE target setting

Common inconsistencies:

- Bottom-up targets do not meet the overall energy needs
- Sum of sector targets does not meet the overall energy needs
- Top-down targets imply unrealistic speed of technology transition

It is crucial to have an accounting framework for:

- Overall future energy needs
- Overall future energy supply mix

Energy system models

Bottom up models

- Accounting – suited to demand side analysis (e.g., LEAP, MAED)
- Optimization – suited to supply side analysis (e.g., MARKAL, TIMES, MESSAGE etc)

IRENA SPLAT-W model: optimization model built based on the MESSAGE modelling framework

NREAP and SPLAT-W

Interested countries can use SPLAT-W to benchmark their power sector trajectory

- Define the future energy mix (installed capacity and power generation by technology to meet a given set of demand)
- Assess implications on policy goals (financial, environmental, energy security etc)
- Compare with alternative future energy mix under different scenarios

NREAP scenario

At the request of ECREEE, a NREAP scenario is being developed for each ECOWAS countries using SPLAT-W.

Note on process

- IRENA's desk-top study, not meant to give recommendations on countries trajectories
- It provides a useful benchmark
- Interested countries are invited to verify data with IRENA (data verification sheet)
- Interested countries are invited to use the tool to develop/adjust the scenario
- Many ECREEE countries have trained national experts

How did we define the NREAP scenario? (1)

Step 1

- Power demand till 2030 is defined for industry, urban, rural demand
- Demand patterns (seasonal, weekly, daily) are defined for each demand category
- Distribution losses are defined for each demand category

Step 2

- Database of existing power plans and international transmission lines are set up, with performance parameters

How did we define the NREAP scenario? (2)

Step 3

- Database of projects (PP or interconnector) under implementation/considerations are set up
- Database of possible power generation options is set up with economic and performance parameters
  - PP with fossil fuel inputs (diesel 1kW system, Diesel 100kW system, utility diesel, utility HFO, coal, OCGT, CCGT)
  - Hydro (utility / decentralized – only to serve rural demand)
  - Biomass
  - Wind (20% CF, 30% CF)
  - Solar PV (utility scale)
  - Solar PV 1 kW decentralized (no storage / 1 hour storage / 2 hour storage)
  - CSP (no storage, with storage, with gas co-firing)
- Database of RE resource availability is set up

How did we define the NREAP scenario? (3)

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Step 4

The model calculates the least-cost combinations of power supply options to meet the specified demand at a specified time, under **certain conditions**

Step 5

Certain conditions includes:

- NREAP regional targets are met
- Reserve margin to be at least 10% (installed 'firm' capacity need to be 10% higher than peak-demand)
- Capacity credits of non-dispatchable RE technologies vary depends on CF and level of spatial distribution of resources locations
- Coal and biomass plants cannot be ramped-up very fast
- Among those interconnecting projects being considered, economically viable ones would be implemented to allow electricity trade
- Other conditions are similar to those assumed under WAPP master plan
- Trade with Central Africa / CO_2 price could be added as an option

Share of renewable [capacity]

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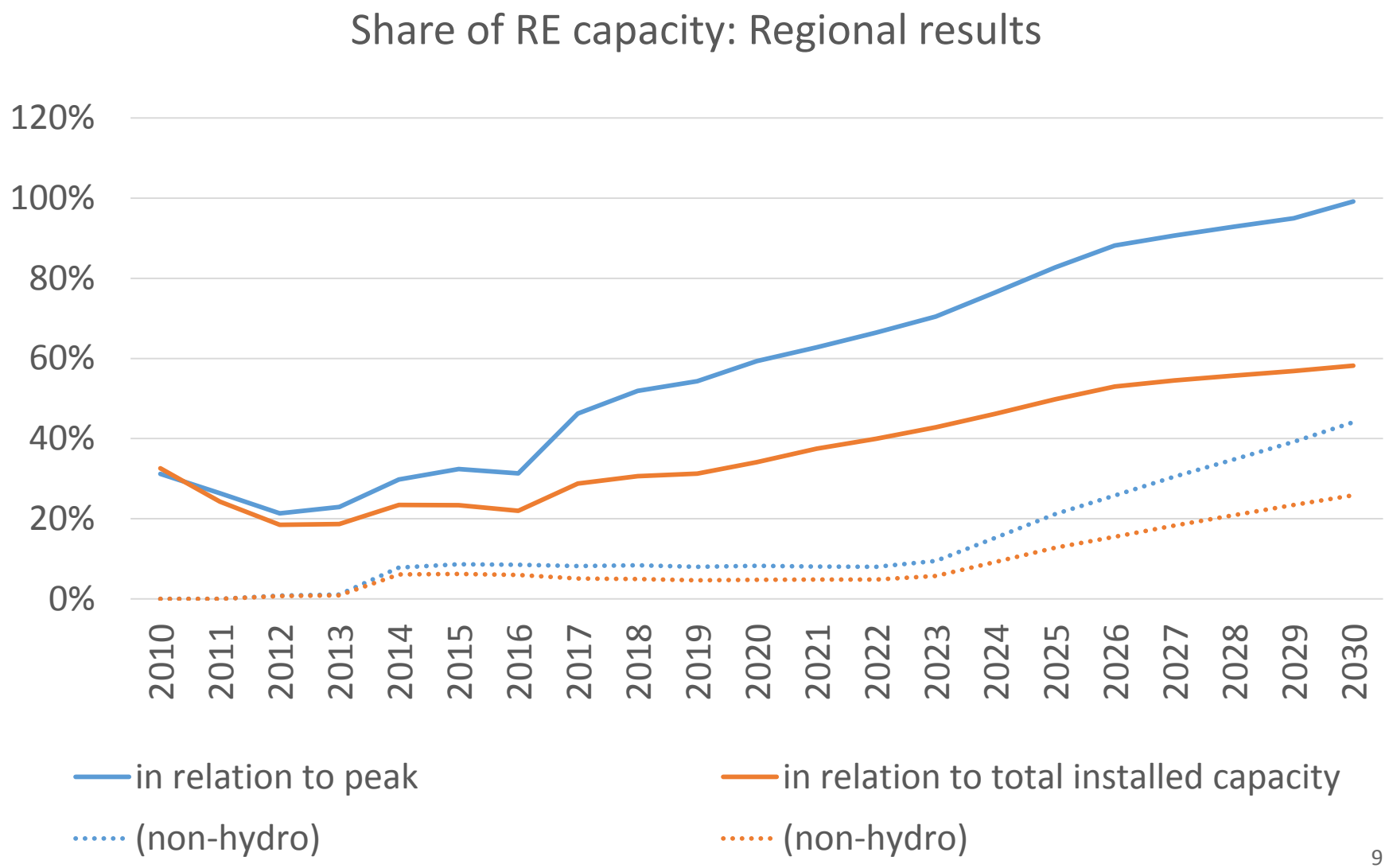

Share of renewable [capacity]

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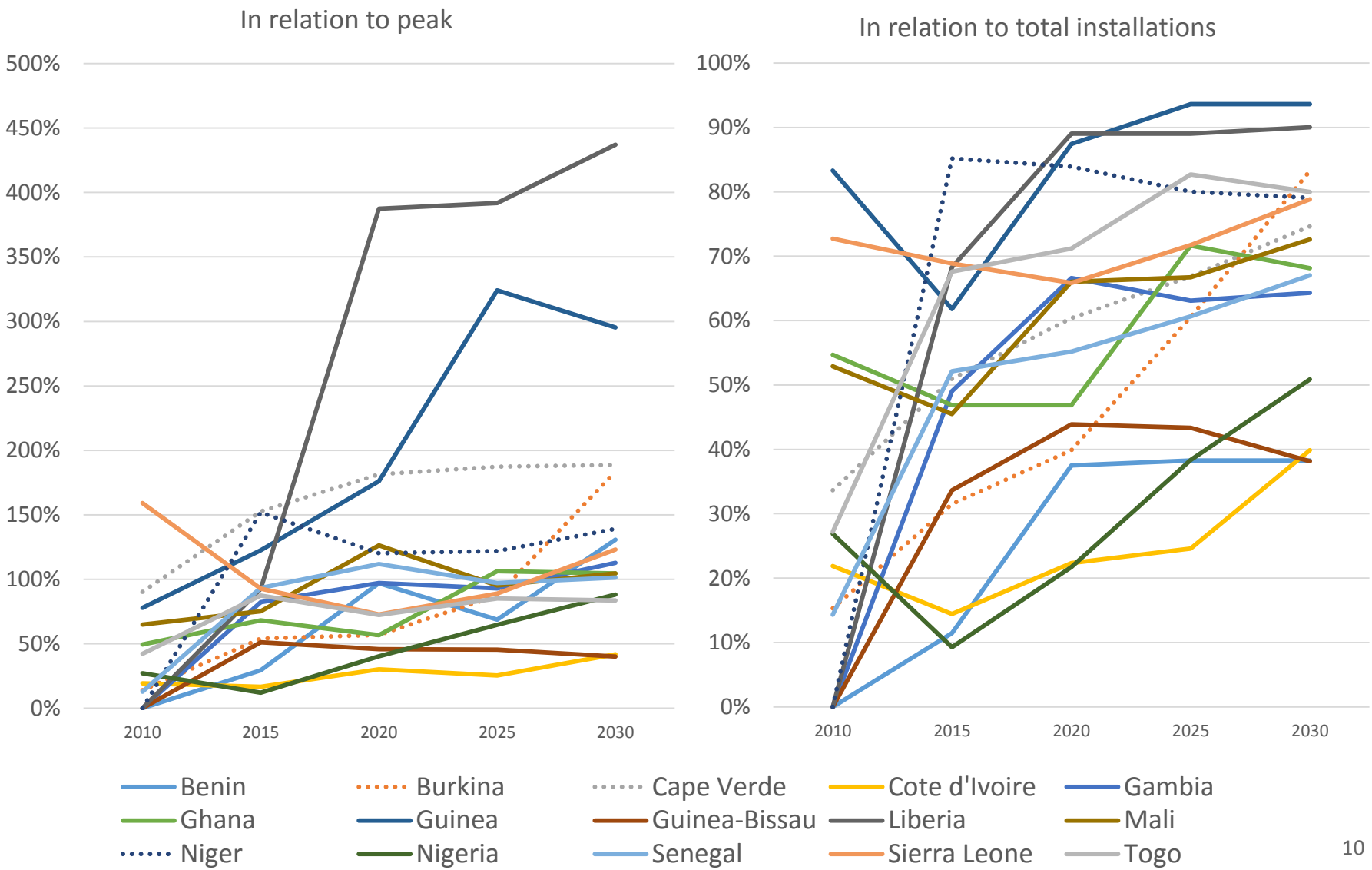
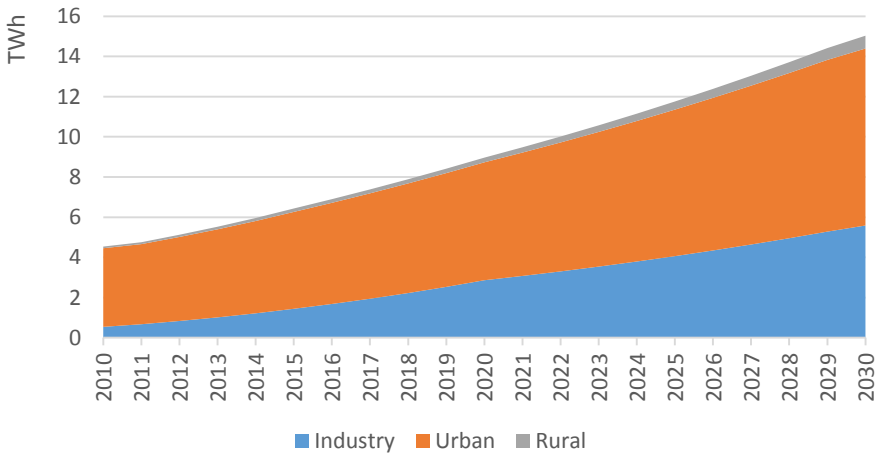


Cote D'Ivoire

Final energy demand



Existing PP (as of 2010)

Gas Turbine: 790 MW

Hydro: 585 MW (1.8-2.4 TWh)

In the pipeline

Gas Turbine: 860 MW

Resources

- Additional identified hydro: 3-5 TWh
- Wind 20% CF: 430 TWh
- CSP 220 TWh
- Solar PV 10,300 TWh

Fuel availability

- Coal: import
- Gas: domestic
- Oil: import

Import from neighbors

- Existing: Ghana, Burkina Faso
- Committed: Ghana, Liberia, Mali

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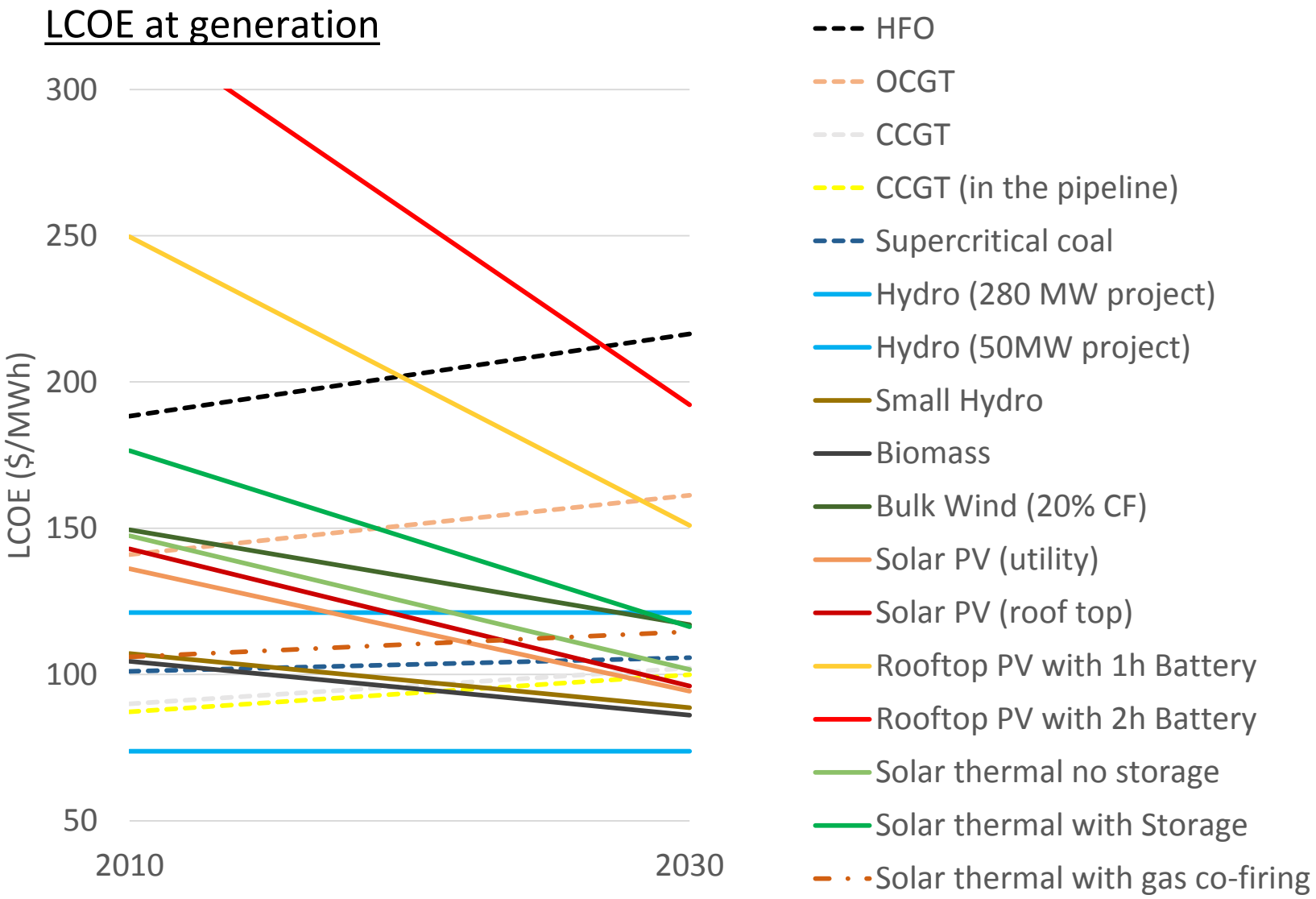

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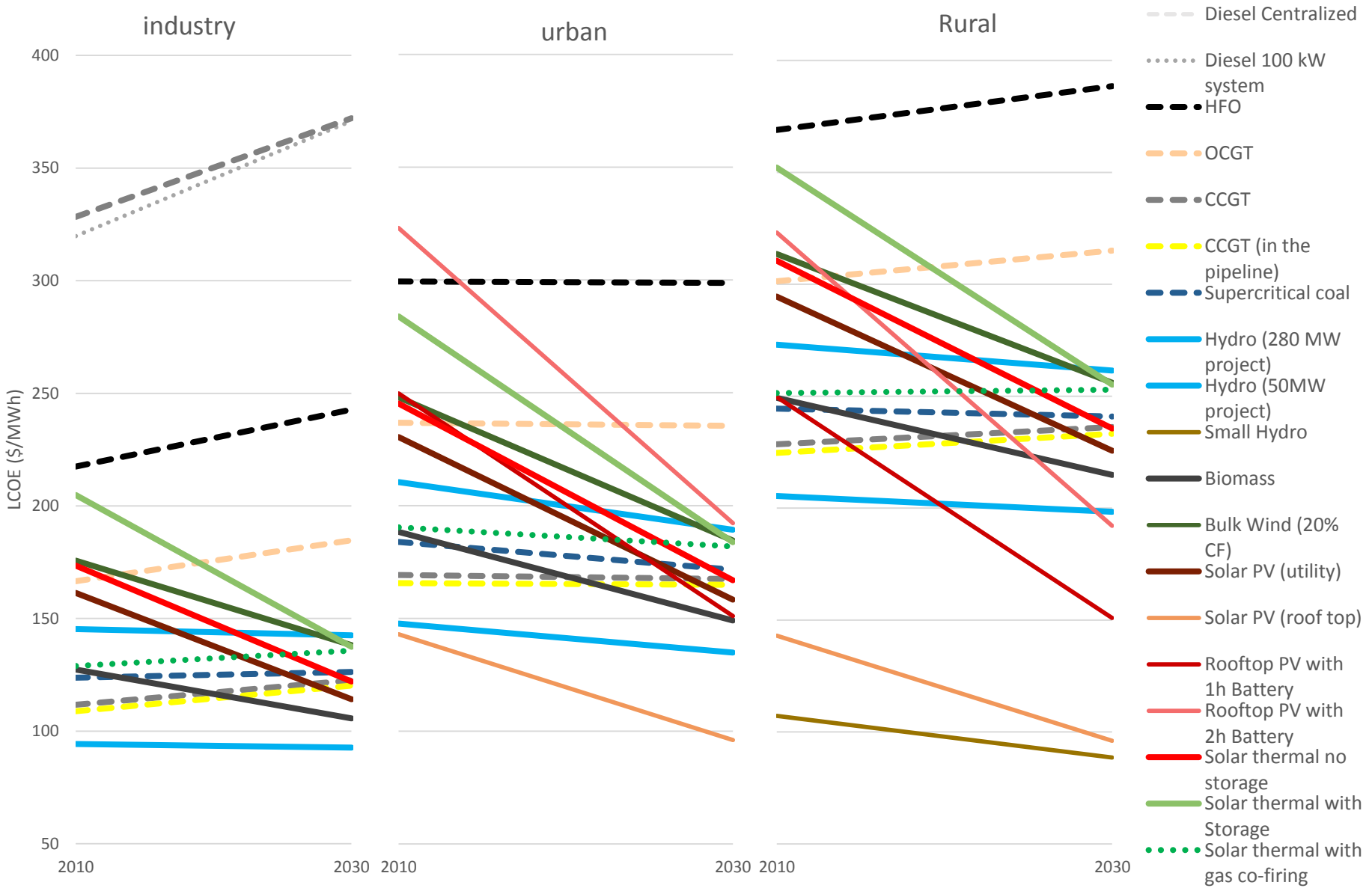
LCOE with TnD needs



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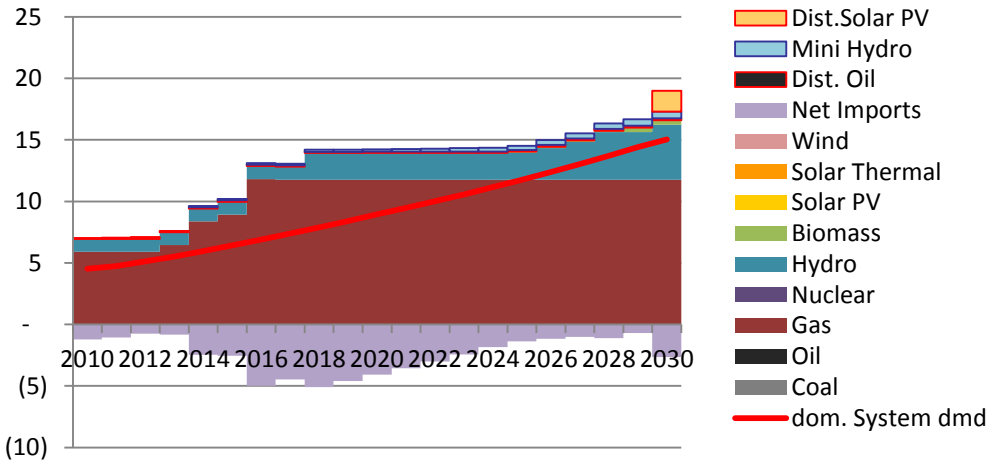
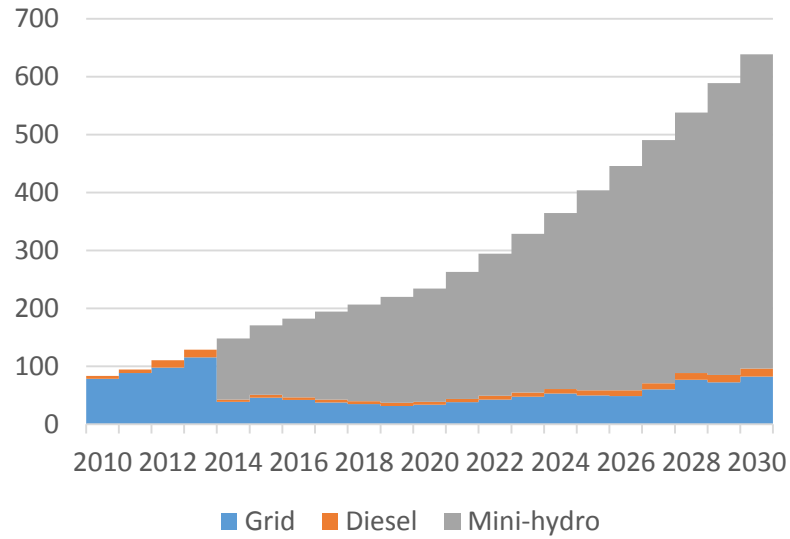
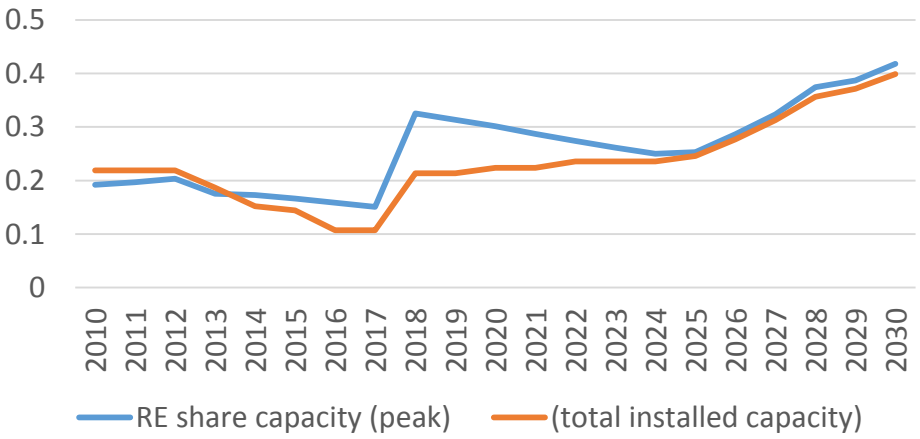
Electricity production [TWh]



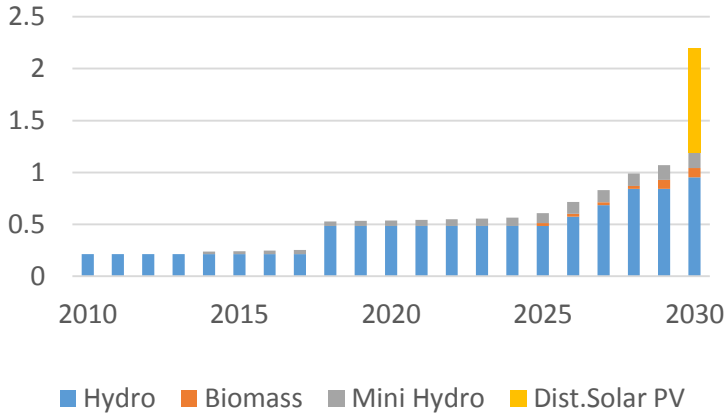
Rural demand [GWh]



Share of RE [capacity]



RE capacity [GW]



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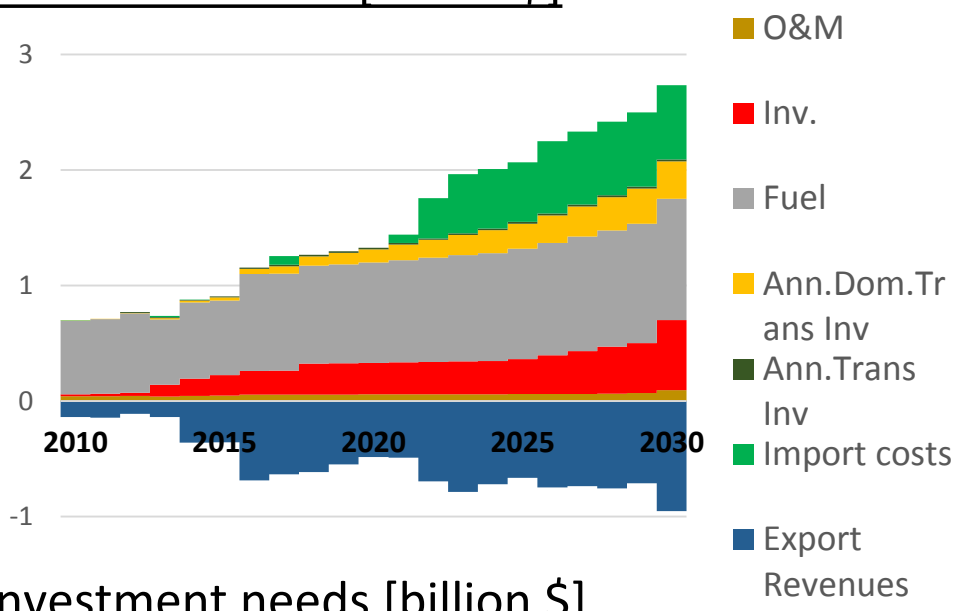
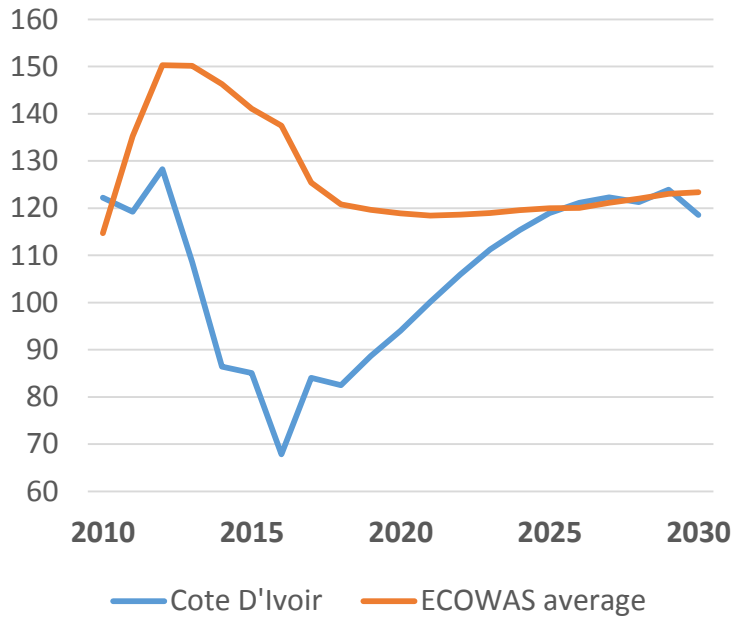
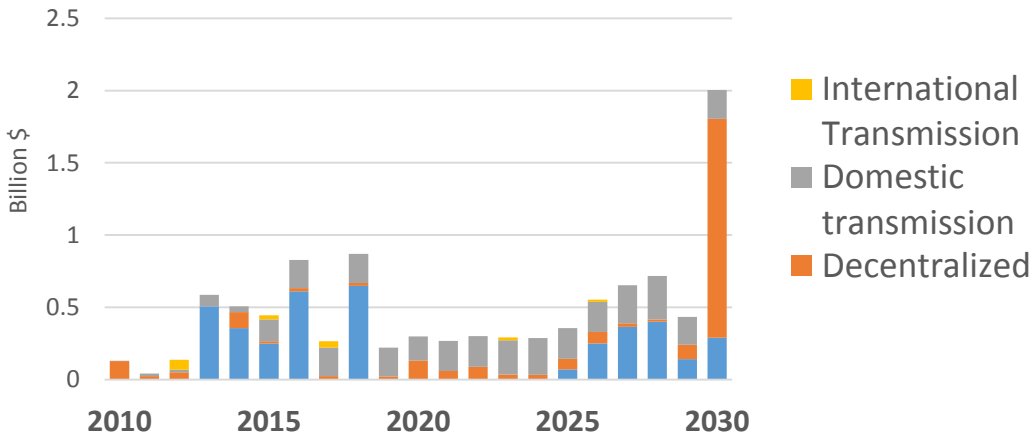
Annualized costs [billion $]



Average generation costs [$/MWh]



Investment needs [billion $]



Contributions to NREAP

Development of power sector baseline trajectory for ECOWAS countries

- IRENA's desk-top study, developed using SPLAT-W
- Normative scenario, illustrating the implications of EREP on each country
- Provide useful benchmark
- Data review sheet can be made available to interested countries
- The SPLAT-W is available with tutorials

Planning for the Global Energy Transition

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IRENA's resources:

Sound statistics and data

- Statistical methodology: statistics@irena.org
- GIS mapping and assessment of theoretical generation potential
- RE technology costing analysis: costs@irena.org
- RE technology brief

- Transparent methodology: SPLAT-W model (benchmarking, transfer the tool, list of resource people)
- Ownership of the planning skill: long term CB is being discussed, engaging local experts

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Thank you for your attention

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