IRENA - PLANNING VRE INTEGRATION - CASE STUDY ANTIGUA

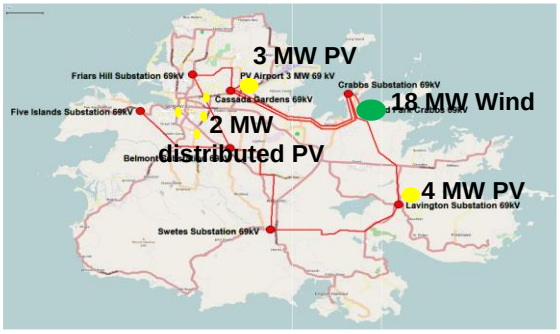
Antigua is an island located in the Eastern Caribbean. With a population of around 83,000, it is the main island in the country of Antigua and Barbuda. In 2014, the power supply in Antigua relied entirely on diesel generation. The total installed capacity was about 110 MW, supplying an annual demand close to 350 GWh with a peak load of 56 MW. To reduce the dependency on imported fuels, the government and the power utility, Antigua Public Utility Authority (APUA), were considering different options to diversify the generation mix. The options included 18 MW of wind power and 9 MW of solar photovoltaics (PV), however there wasn't a clear understanding and consensus among the local stakeholders regarding the impact this new type of generation would have on the reliable operation of the power system.

To solve this issue, the government of Antigua and Barbuda, APUA, and IRENA completed a technical planning study assessing the impact of the integration of variable renewable energy into the grid. Four scenarios, summarized in the table below, were set for this assessment. Given the high potential for the development of solar PV in the island, an additional analysis estimating the hosting capacity for solar PV into the current system, without major upgrades, was conducted.

| Scenario | Baseline | PV | Wind | PV + Wind |
|---|---|---|---|---|
| Distributed PV [MW] | 0 | 2 | 0 | 2 |
| Centralized PV [MW] | 0 | 7 | 0 | 7 |
| Wind [MW] | 0 | 0 | 18 | 18 |
| Total VRE [MW] | **0** | **9** | **18** | **27** |

A simulation model of the power system in Antigua was implemented, using the PowerFactory software, to support the assessments. The conducted analyses followed the procedures established in IRENA's methodological guide. Generation adequacy assessments as well as steady state and dynamic network studies were performed.

The results of the study showed that the integration of PV and wind power generation according to the possible expansion pathways (9 MW PV and 18 MW wind) was feasible from a technical perspective, provided that several mitigation measures, which do not require major investments or upgrades, were implemented. According to the results of the study a share of 16% of the total annual generation could be reached in the scenario with 9 MW of solar PV and 18 MW of wind, with negligible levels of curtailment.




Another relevant output of the study was related to the hosting capacity of today's system: 37.5 MW of solar PV, covering around 17% of the current annual electricity demand, could be integrated with levels of curtailment below 2 % without violating the established reliability criteria nor the need for major system upgrades

The assessment showed that going beyond 37.5 MW of installed PV generation, without any storage or demand side management measure, would result in increasing levels of curtailment due to system reliability constraints (see plot on the right). Therefore without system upgrades, no considerable increase in annual energy share would be achieved by increasing the installed solar PV capacity beyond this point.

For further information on this study please contact *islands@irena.org.*