SHORT SUMMARY

For the most part, electricity markets and transmission systems around the world have been designed to accommodate large power stations with predictable output. However, as we seek increasing amounts of renewable energy to combat the effects of climate change, it is becoming apparent that our conventional electricity markets are not necessarily suitable for the smaller, variable forms of renewable generation, to the extent that they are acting as a deterrent to new renewable development.

Some of the features of renewables that make them 'different' from conventional plant include:

- ***Variable production***: Most market mechanisms target costs at market participants who cause system imbalances. Variable renewable generators tend to be more exposed to the costs and risks of market imbalance than conventional plant, in particular wind is only predictable over short timescales;
- ***Remote locations***: Generators sited in remote areas in order to harness their resource (wind, water etc) generally face higher costs for accessing the grid and transporting their energy to demand centres than generators which are able to locate closer to their customers;
- ***Low utilisation***: When market or transmission charges are based on a generator's maximum capacity, generators which typically operate only for a limited proportion of the time (e.g. only when the wind blows) are at a cost disadvantage compared to generators who have higher levels of utilisation;
- ***Size***: due to charging structures and the administrative costs to participate in the market, smaller generators face disproportionately high costs of market participation compared to larger power stations and integrated portfolio generators;
- ***Technical demands***: Smaller, variable generation makes different technical demands on the electricity networks than large stable plant. Inappropriate technical rules can be onerous for renewable generators and cause problems for the Grid.

IEA RETD commissioned a study by IPA Energy + Water Economics to consider the market and transmission mechanisms in its member countries in an attempt to identify practices that address these issues and could increase the deployment of renewable generators. The study investigated:

- ***Market design and operation*** – how renewable generators gain access to buyers;
- ***Grid access*** – how renewable generators gain access to the networks in order to transport electricity to their customers; and
- ***Cross-border trading mechanisms*** – whether and how renewables gain access to markets and customers in neighbouring jurisdictions.

The study concluded that there are broadly two models for tackling the issues identified above (although they are not exclusive and many countries use a combination of both):

(1) ***Special conditions:*** Renewable generators are given 'special' treatment that recognizes the technical constraints and environmental benefits of the technology, and they are protected from some of the costs and risks that disadvantage them; or

(2) ***Market integration:*** Renewables are treated broadly in the same way as conventional generators, but efforts are made to adapt the market or transmission arrangements to minimise the negative impact on renewables.

The study identified measures taken in participating countries to assist integration, as well as considering what else could be done to improve the position of renewables operating within market-based arrangements.

In relation to ***Market Mechanisms***, there are two options, either:

- Allowing market participants to trade as close to real time as is practical to give renewable generators the opportunity to reduce their exposure to imbalance costs and reducing the volatility of imbalance charges, potentially by charging on the basis of average rather than marginal costs; or
- Partially or completely insulating renewable generators from market risk and imbalance costs.

In relation to ***Grid Access*** there are a number of ways to facilitate access:

- Connections:
  - defined and transparent timescales for connection;
  - preconditions for connection that are proportionate to project economics; and
  - shallow or super-shallow connection charges.
- Grid development and reinforcement:
  - advance strategic reinforcement of potential areas for renewable generation;
  - optimise use of the network through flexible, non-firm access rights rather than firm access for all plant;
- Technical standards:
  - less secure planning standards required for clusters of variable renewables; and
  - technical rules (Grid Code) that are appropriate to the technology.
- Transmission charges:
  - reducing any additional charges to generators for being further from demand; and
  - reducing the proportion of the charge based on a generator's capacity in favour of a charge based on energy output.

In relation to ***Cross-Border Trading***:

- Alleviating congestion and increasing interconnector capacity between countries to allow trade across borders – increasing the efficiency of renewable despatch, providing locational diversity and statistical smoothing across the region, and sharing of ancillary services and reserve;
- Harmonising energy and interconnector trading rules and timing to allow interconnector and market positions to be managed. The study found that 'market coupling' has been extremely effective in maximising the efficiency of interconnector utilisation by renewables;
- Allowing intra-day trading of interconnector access, to allow unpredictable generators to balance and making small enough blocks of capacity available i.e. 1 MW; and
- Potentially allowing imported renewable generation to qualify within national renewable support mechanisms (although it should be noted that this may impact on the ability of some jurisdictions to continue to offer such support).

In combination, these mechanisms have the potential to reduce disproportionate costs for variable renewable generators to participate in markets, and if implemented could therefore reduce the required level of financial support.