

# Utility Planning and the Renewable Energy Supply Curve

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## Vietnam as a case study

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### Expectations

- 126 SHP projects are presently registered with the Ministry of Industry (Mol) with a capacity of over 2,100MW.
- The official power development strategy document of the Government states  
Give priority to hydropower development, especially the multi-purpose projects (water supply, flood control, drought control etc.). Encourage several forms of investment in small hydropower plants in order to develop this clean renewable energy resource.

### Reality

- The commercial banking system resists loan tenors of much more than 7 years, without which it is hard for developers to reach the tariff targets set by Mol
- Electricity of Vietnam (EVN), perhaps understandably, is unenthusiastic about embracing the idea of 2,100 MW of small run-of-river small hydro plants.



## Constraints

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- PPAs negotiated on an *ad hoc* basis, based on cost plus “fair return”
- High transaction costs: no standardized PPA
- EVN insists on confidentiality of PPAs. The published tariff guidelines (by MoI) are very broad ranges (3.0 – 4.7 UScents/kWh).
- Developers find it hard to optimize project design and finalise detailed feasibility studies not knowing what the tariff will be.

### Result:

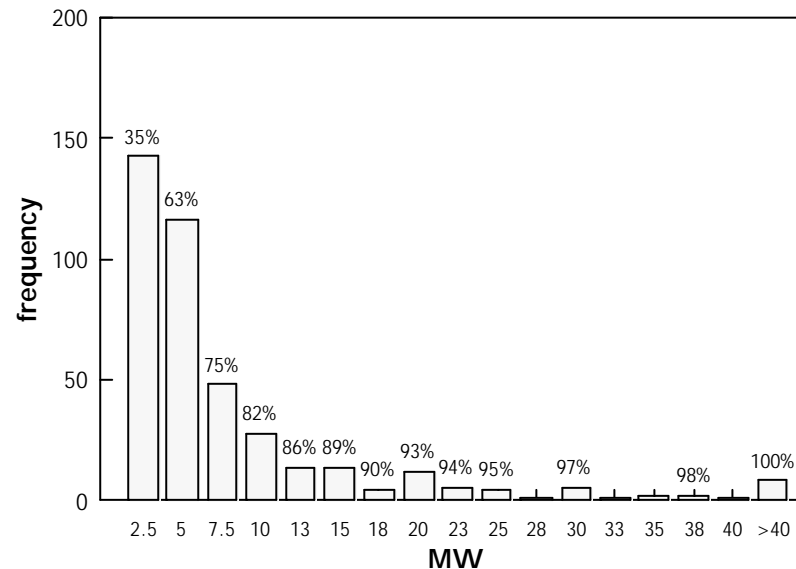
- Very few projects have reached financial closure!



## Rational utility planning requires:

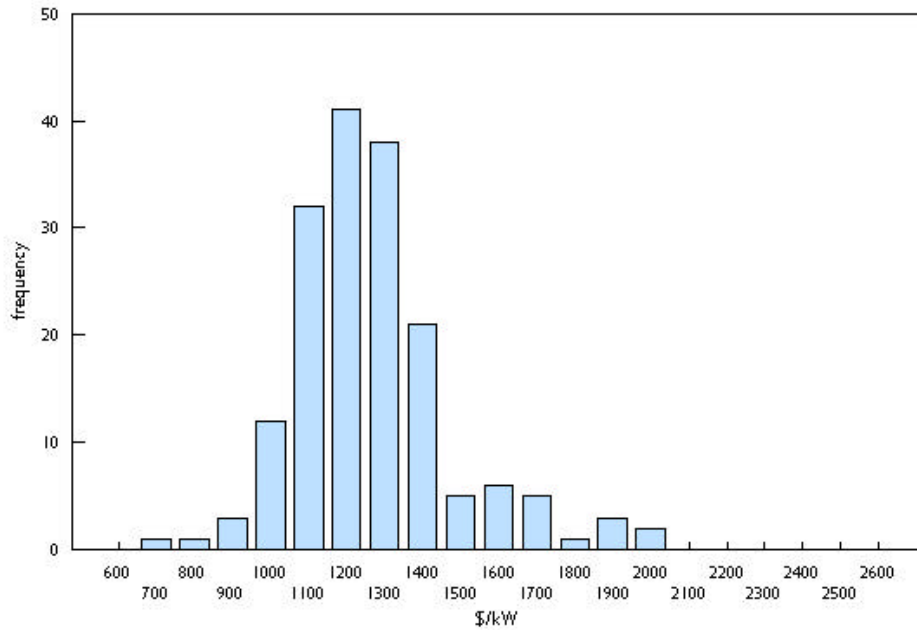
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- Knowledge of what is likely to be economic if the tariff were based on its avoided costs.
- This can be determined by preparing an indicative renewable energy supply curve: the quantity that is economic is given by its intersection with the avoided cost.
- The Draft National Master Plan for small hydro lists 408 projects totaling 2,925 MW, 82% of which are in projects of less than 10MW.



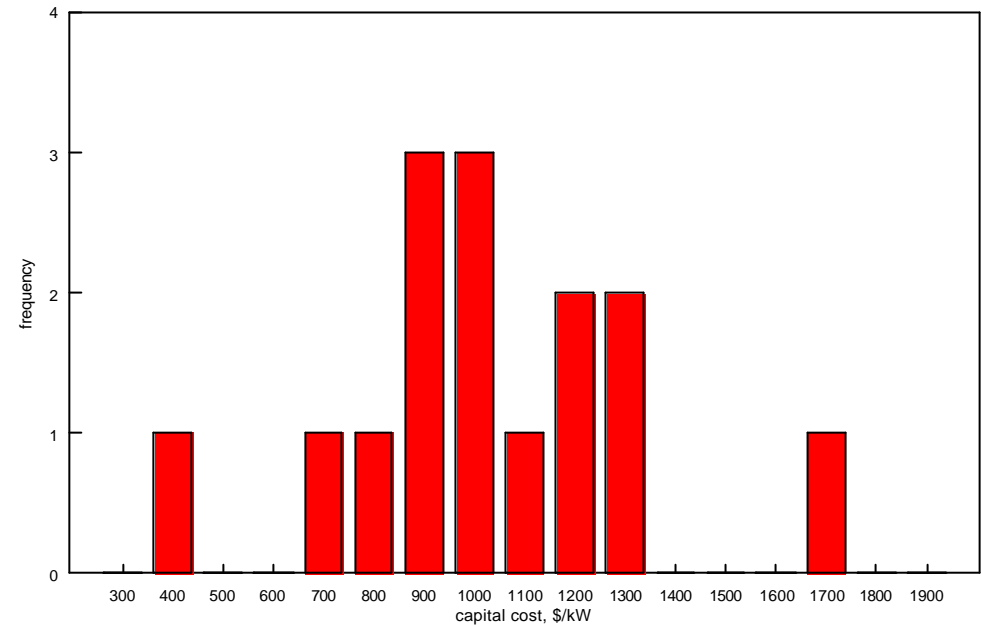
# Distribution of capital costs of SHP

## Vietnam



As estimated in the Master Plan

## Sri Lanka

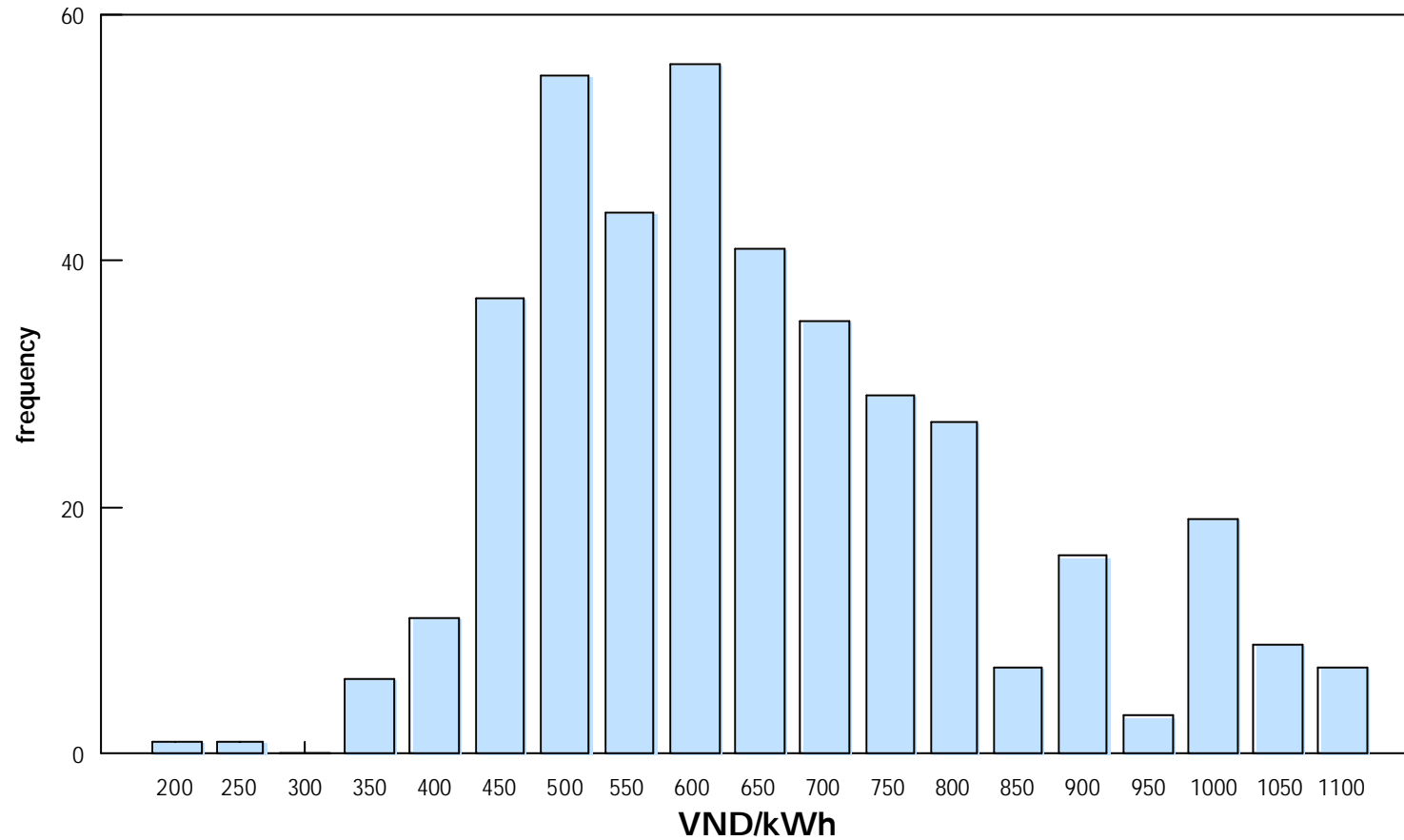


(projects actually built under World Bank Energy Service Delivery project)



## Distribution of energy generation costs (as economic costs)

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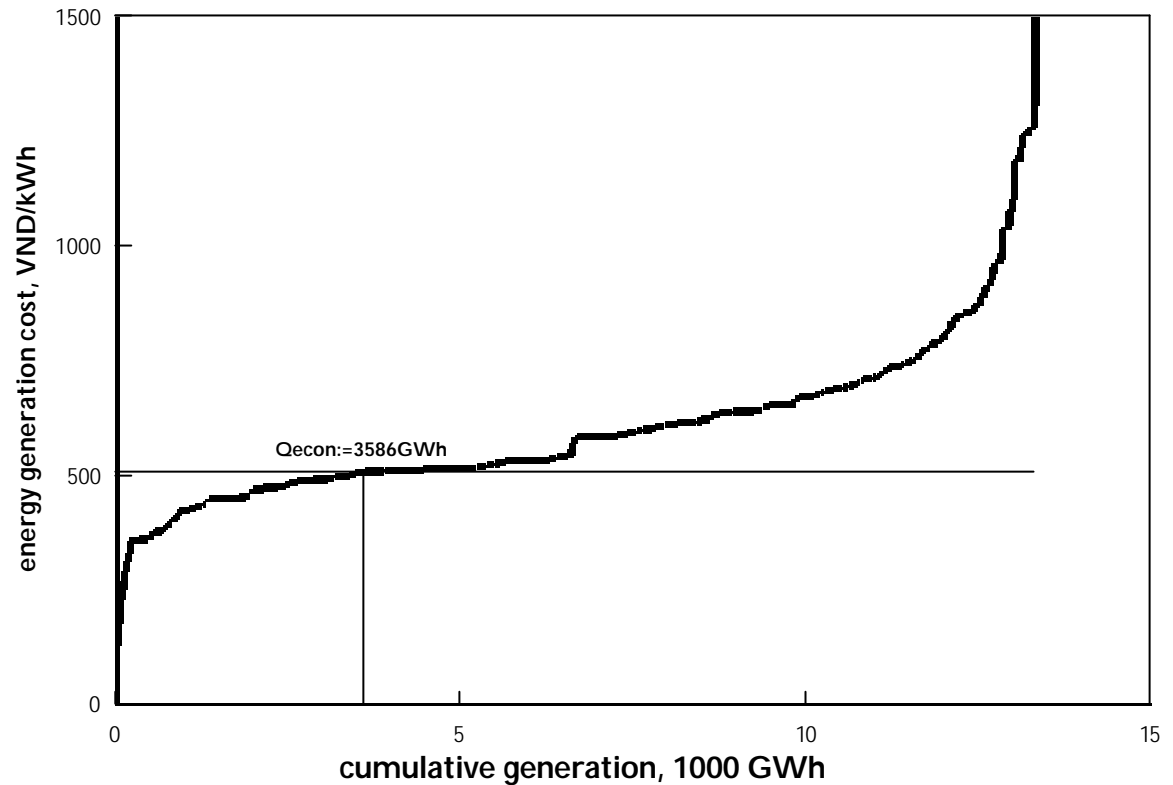


600 VND/kWh = 3.8 UScents/kWh

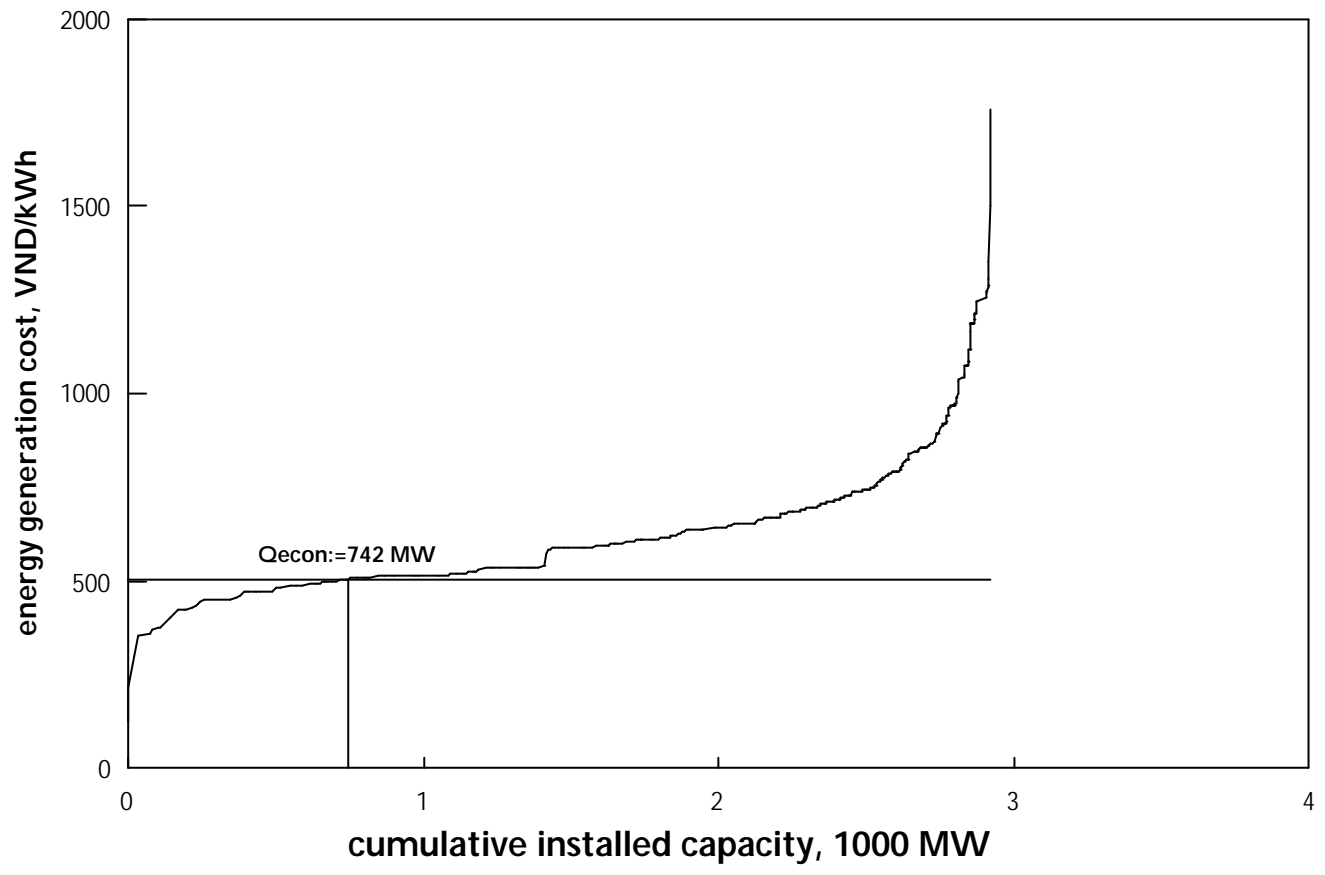


## Small hydro supply curve for Vietnam: energy

- Study for EVN estimates avoided cost at MT at 505 VND/kWh (3.1 UScents/kWh)
- At current *economic* fossil fuel prices, economic avoided cost closer to 600 VND/kWh (3.7 UScents/kWh)

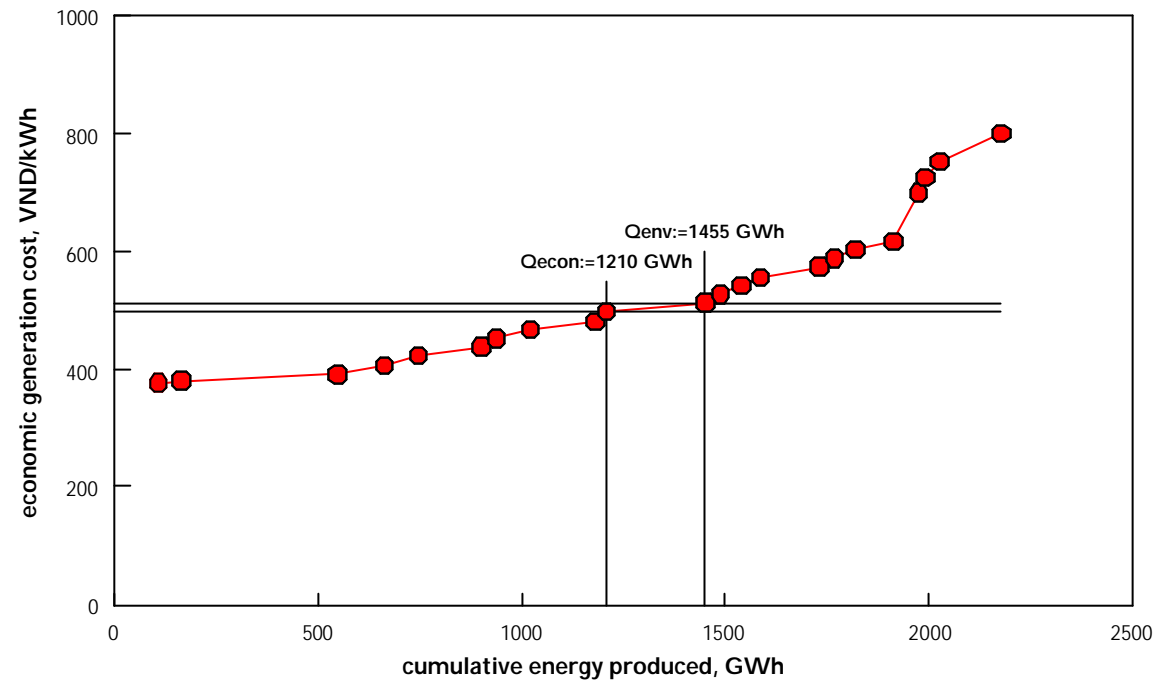


# Small hydro supply curve for Vietnam: capacity



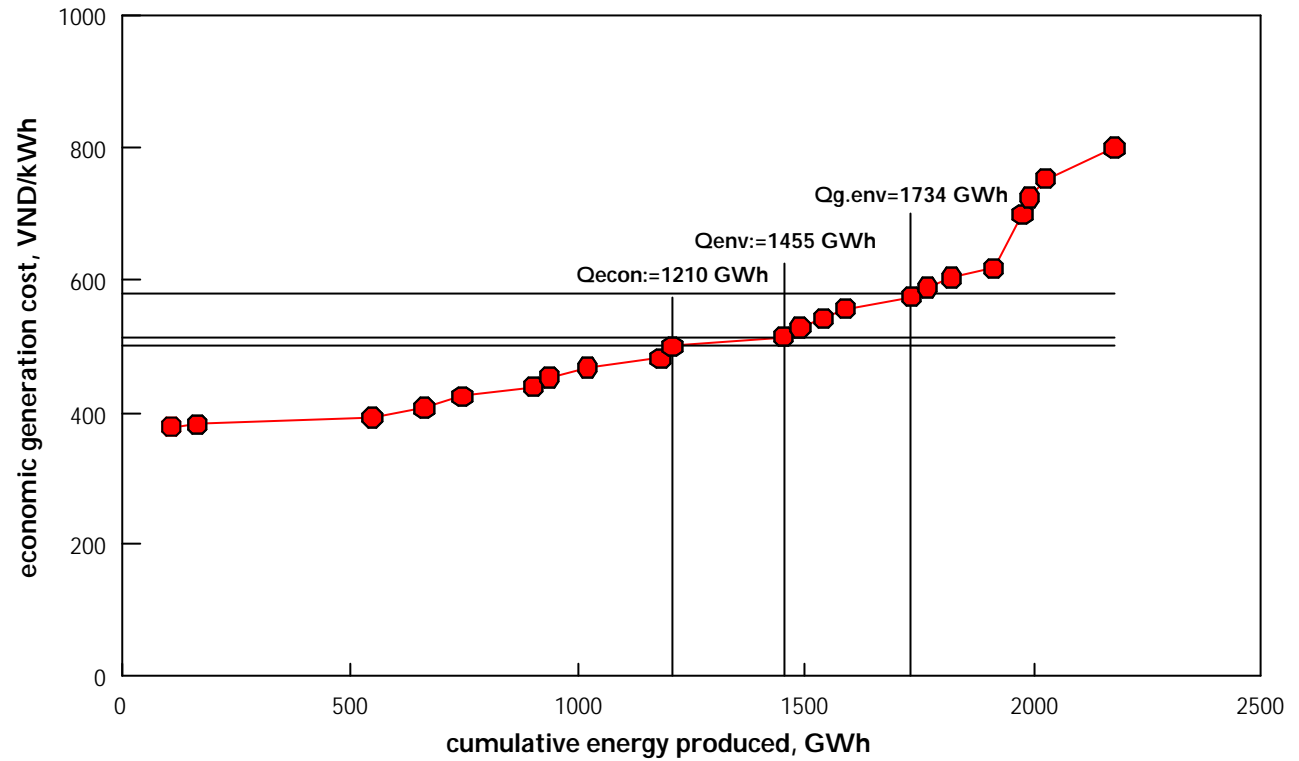
## Impact of local environmental costs

- No environmental damage cost studies have been done in Vietnam
- Available estimates are all based on some form of benefit-transfer method. Extrapolation of studies available for adjacent provinces in China gives a value of around 20 VND/kWh (UScents); Study by the Research Centre for Energy and Environment in Hanoi suggests values of 30-40 VND/kWh for coal plants.
- Supply curve is flat: even small increments have a big impact on optimal quantity. 20 VND/kWh (0.1 UScent/kWh) increases  $Q_{ECON}$  by almost 20%



## Impact of avoided global externality cost

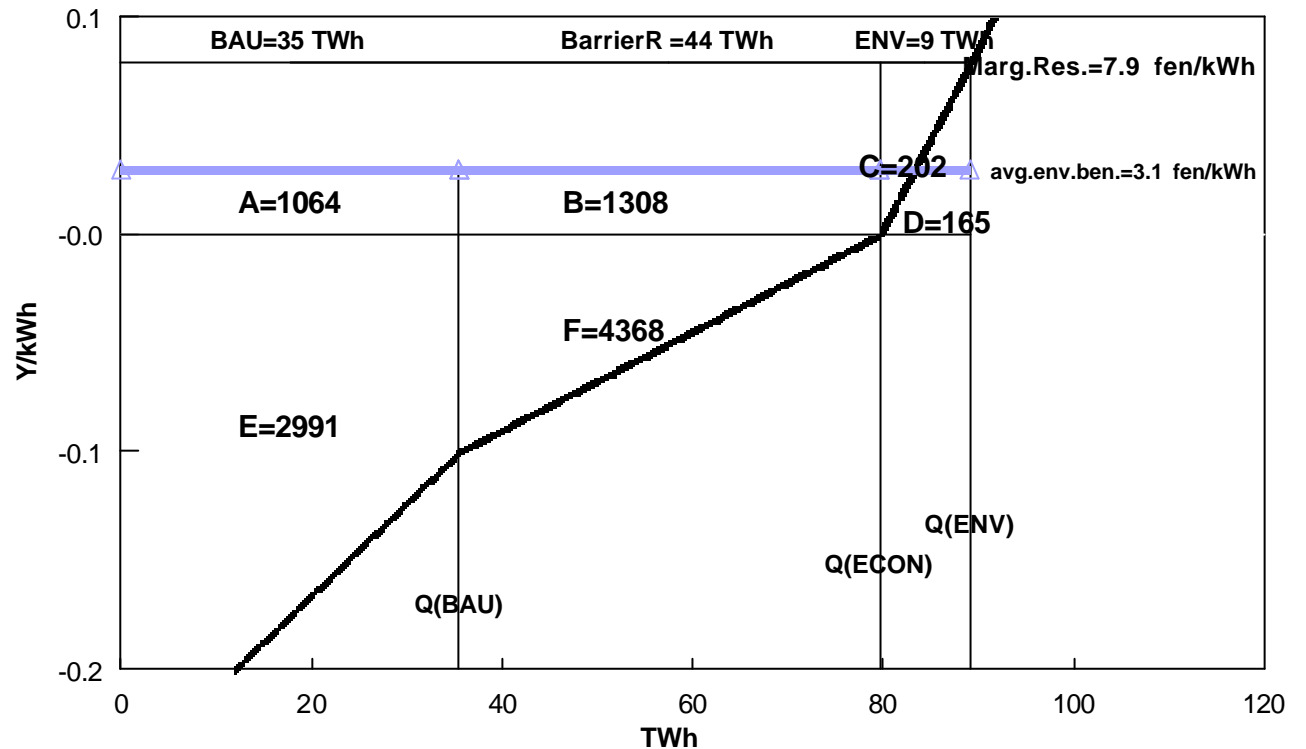
- At a carbon price of \$5/ton CO<sub>2</sub>, global externality cost adds 62 VND/kWh to the avoided cost
- This increases the optimal quantity by another 20%



## Supply curves as a useful tool for planning: China

- Incremental costs follow directly as areas under various sections of the curve
- For example, in China (study for China Renewable Energy Scaleup Project, CRESPE), right, the 2010 benefits of implementing  $Q_{ENV}$  calculates as the sum of the areas  $A+B+C+D =$  Y9.93billion (\$US1.2 billion)

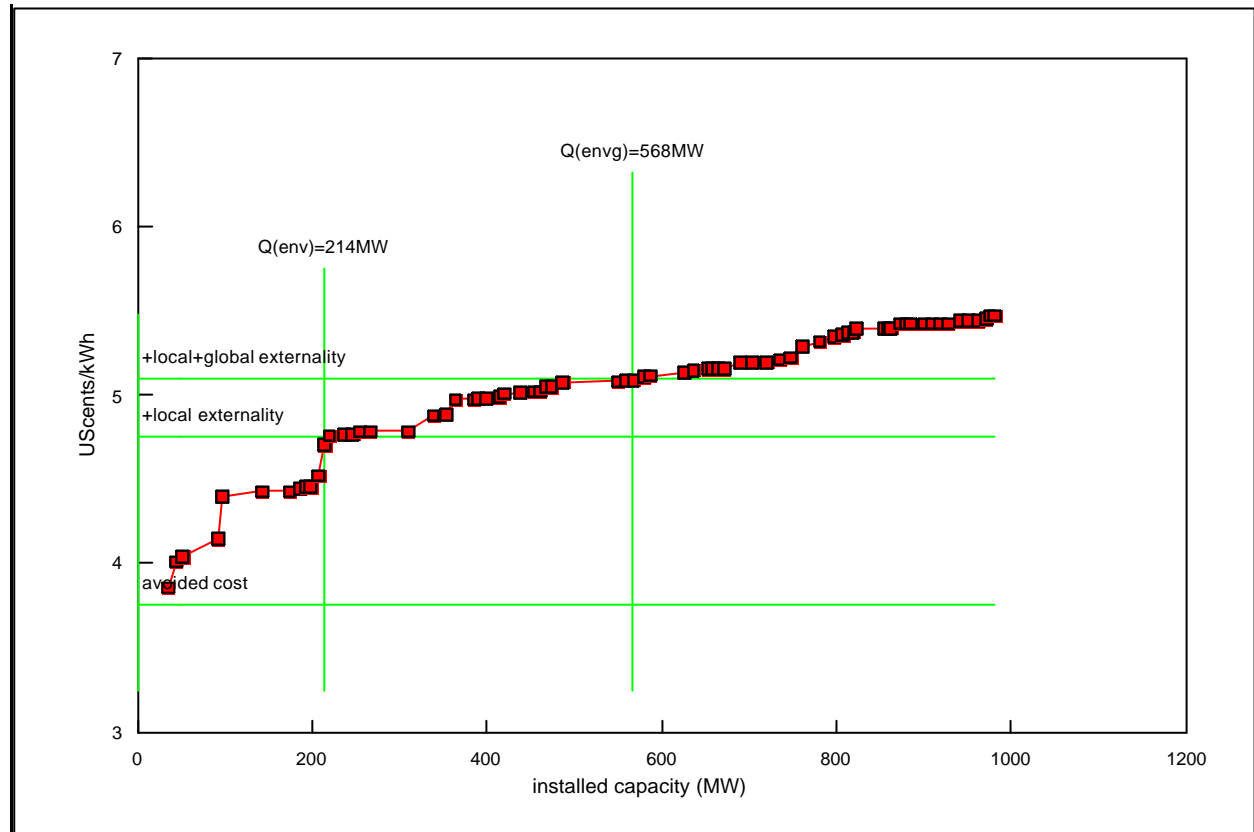
*Renewable energy supply curve, China 2010*



# Supply curves as a useful tool for planning: Croatia

## *supply curve for wind projects*

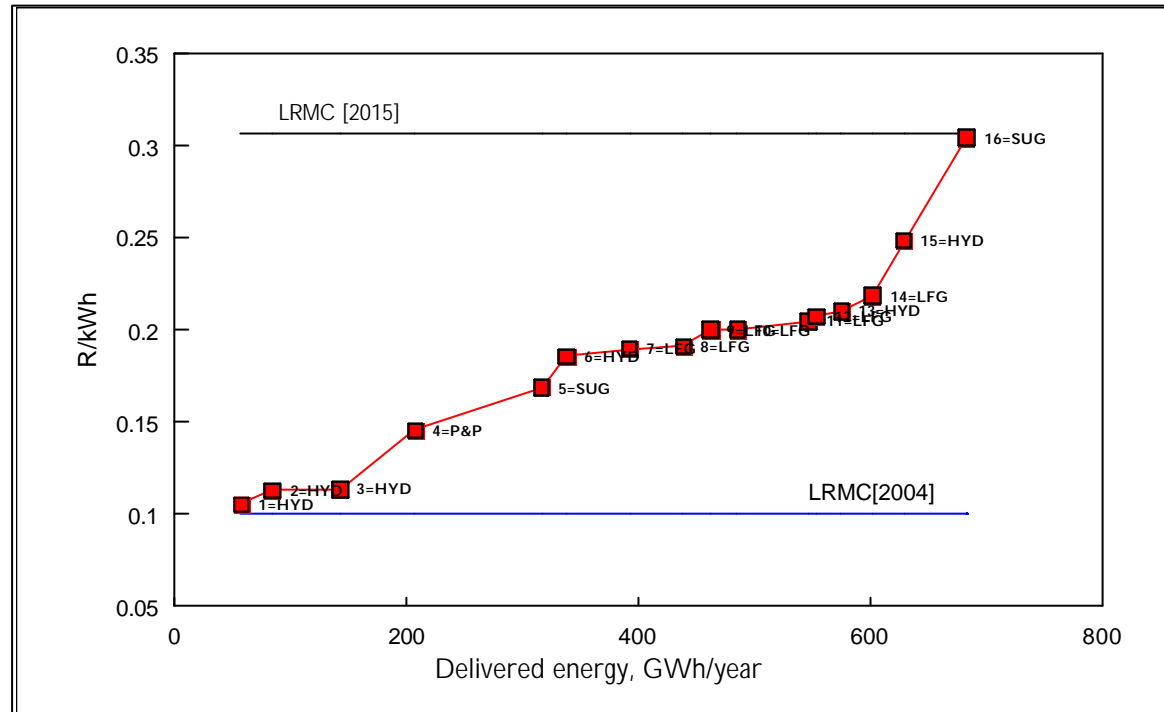
- In Croatia, the supply curve was used as a basis for setting targets for wind power



## Supply curves as a useful tool: South Africa

- In South Africa, the supply curve of identified projects was used to set targets for the REMT project
- South Africa is a particularly difficult environment for grid-connected projects, because of very low pool prices (a consequence of ESKOM over-capacity).

*Supply curve of identified projects*

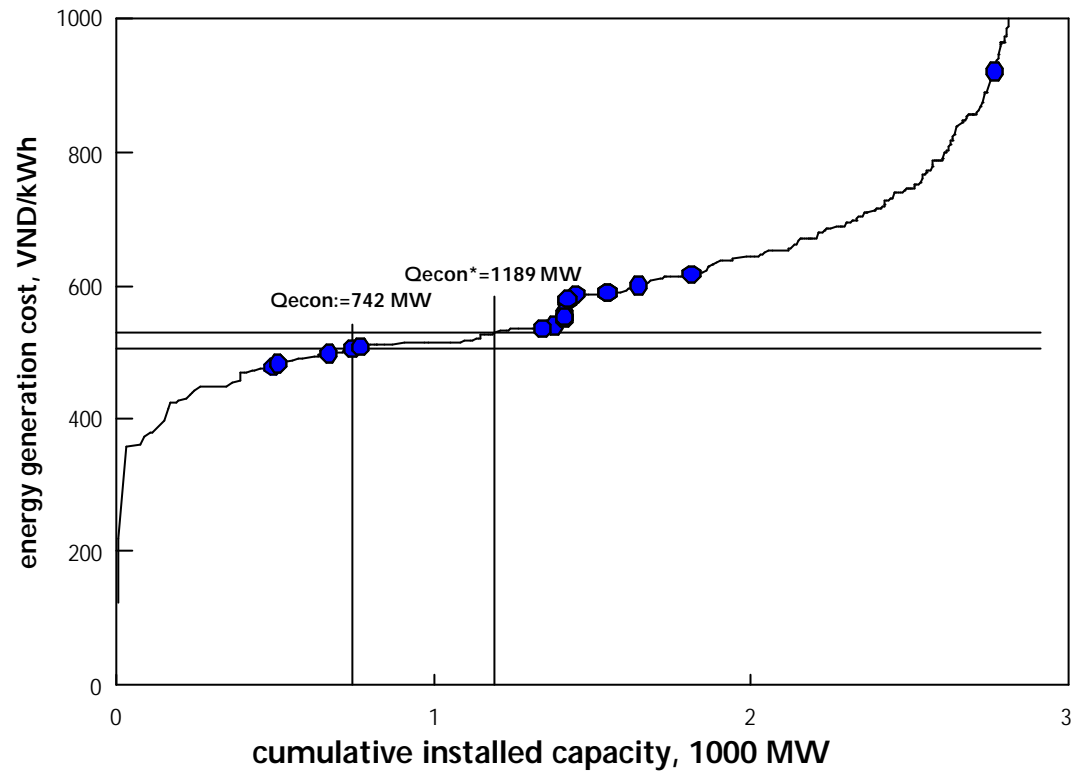


Source: World Bank, Economic Analysis for the Renewable Energy Market Transformation Project (REMT)



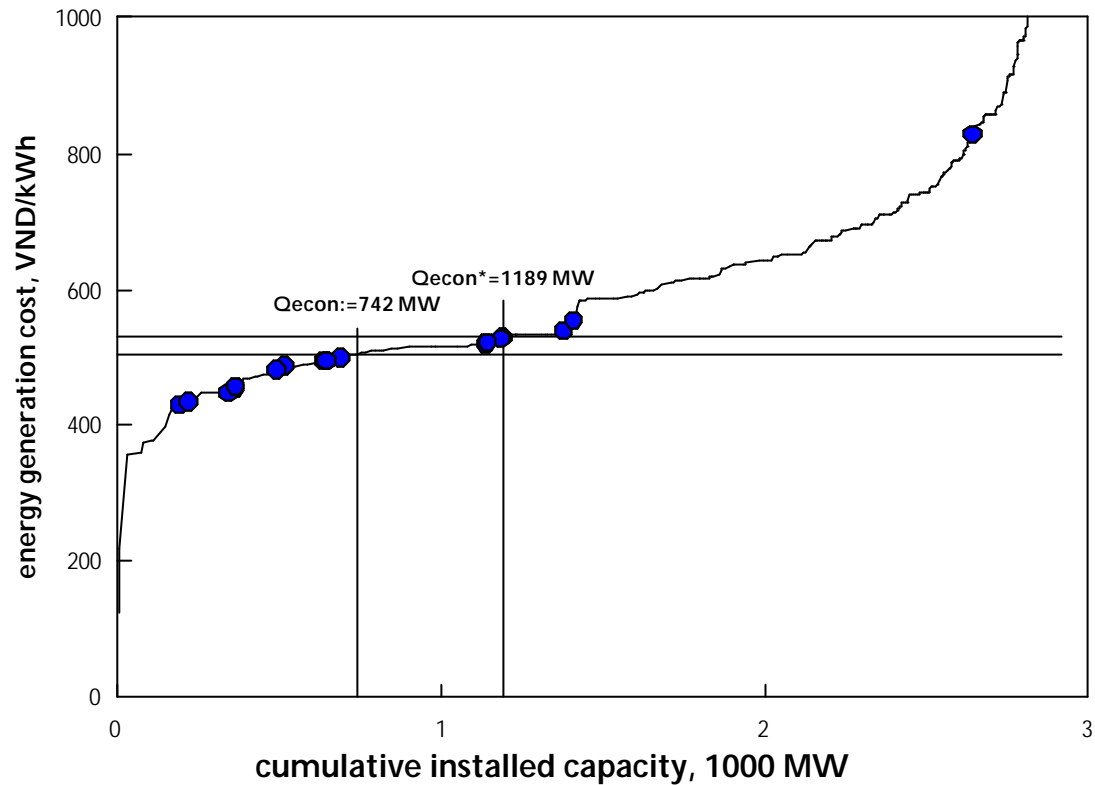
## Location of projects on the Vietnam supply curve!!

- To verify the overall supply curve, we randomly selected 20 SHP FS for detailed study.
- When plotted on the supply curve, most are uneconomic!!



## FS capital costs reduced by 10%!

- Most projects are now economic!
- Because PPAs are confidential, unclear to what extent cost estimates in FS are realistic or overestimated for sake of minimizing the apparent FIRR



## Hence recommendations that follow:

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Implement a standardized PPA and a published avoided cost tariff that minimizes transaction costs of implementing renewable energy:

- EVN gets out of the business of negotiating tariffs and rates of return. The only item of oversight that remains with EVN is that a proposed facility meets the grid code. (Why should EVN care about developer's FIRR?!).
- Mol gets out of the business of approving FS. The only issue of oversight that is necessary is dam safety and compliance with civil construction codes: the review should therefore be limited to a specific set of technical issues only.
- Whether a project is financially sound is best left to the Banks: the key area of technical assistance required is to train loan officers in the banking system on how to assess risks (hydrology risks, construction risk, etc).



