

# Certificates for developing renewables and efficient use of energy

By

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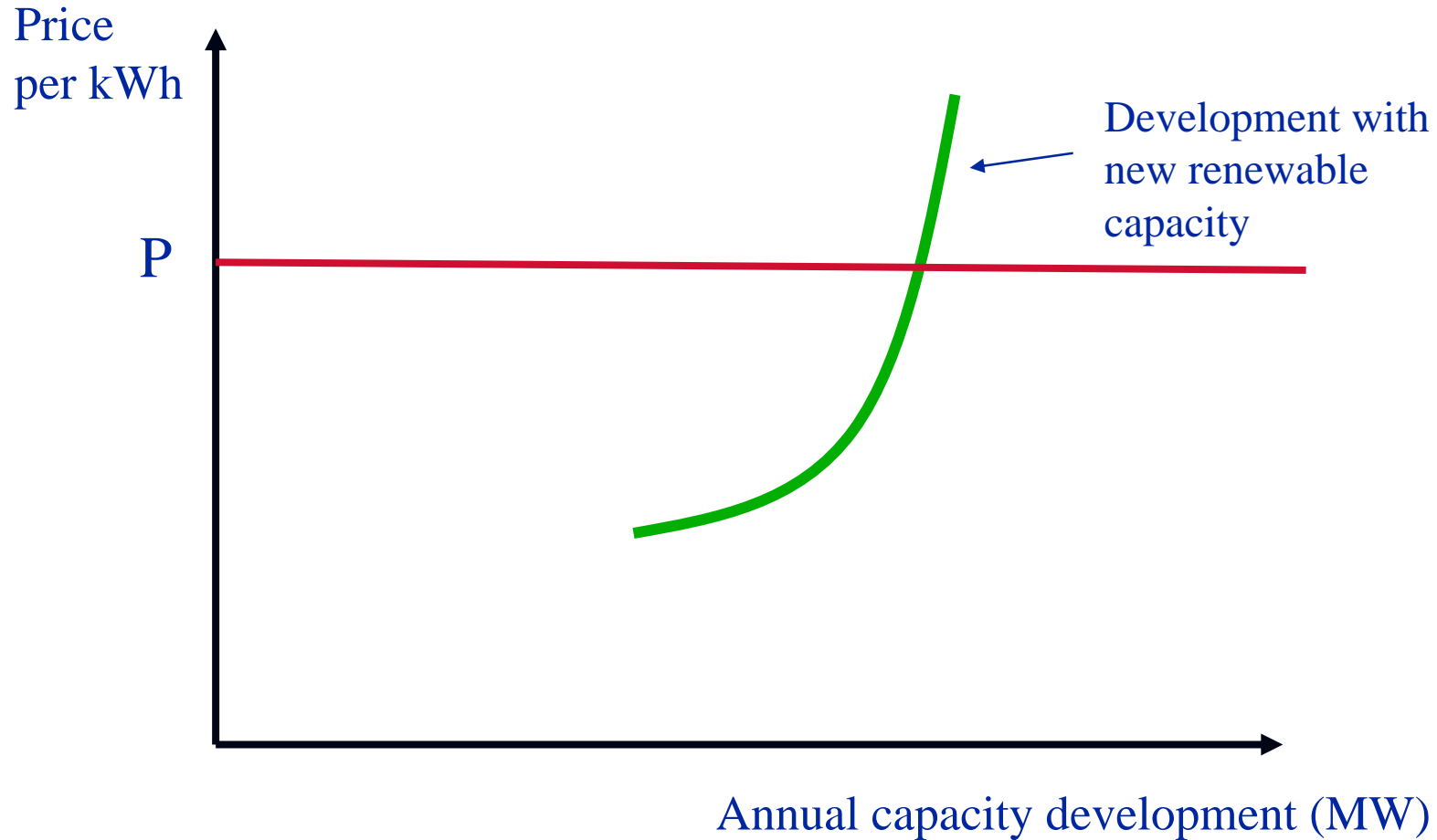
- A green certificate system compared to a fixed feed-in tariff approach
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# Setting the scene

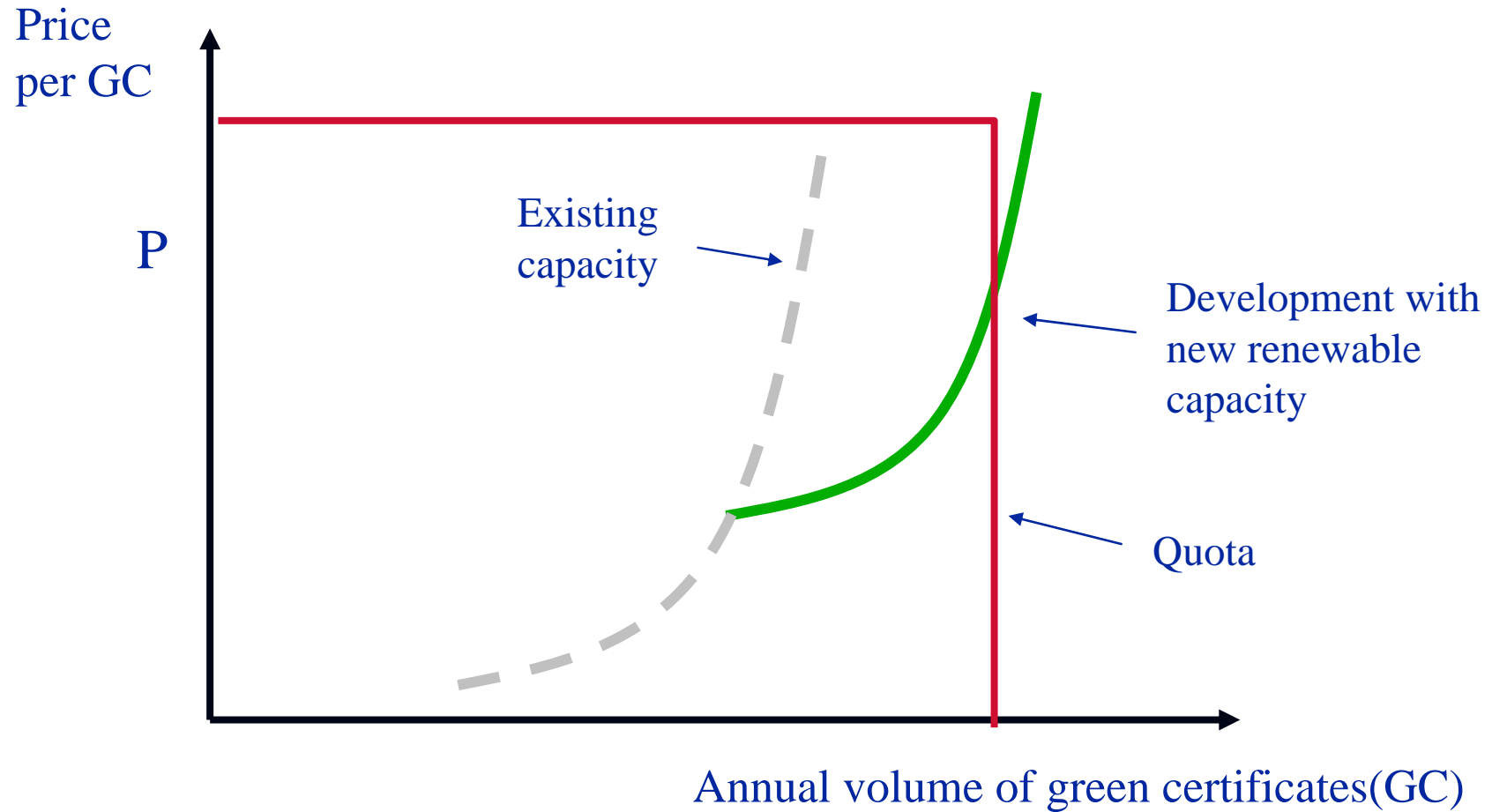
## Background

- Reduction of greenhouse gases - Kyoto protocol
  - Common EU-reduction 8% by 2008-12 compared to 1990
  - Implemented as national targets - Danish reduction 21% by 2008-12 compared to 1990
- Liberated electricity markets
- Development of renewable energy technologies
  - Especially wind power experiences a rapid development
  - Targets for renewable deployment in the EU member states

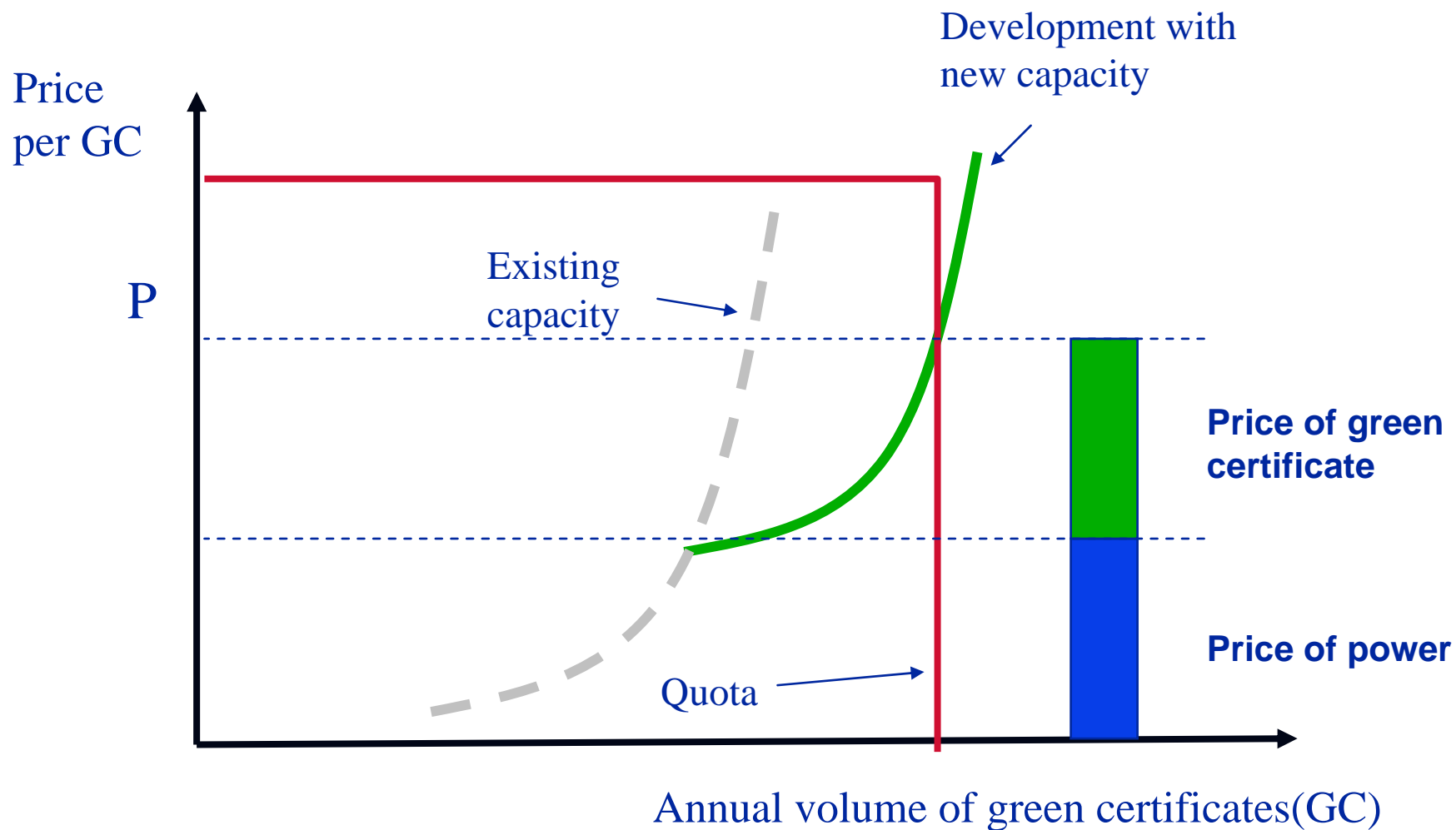
# Fixed feed-in tariff



# A green certificate market



# Power and certificate price



# Main objectives of the green certificate market

- To ensure an efficient development of renewable energy technologies to reach the agreed targets
- To release the Government from the burden of subsidising renewable technologies
- To let the market decide the additional price of green electricity compared to conventional power

# Main characteristics of a green certificate market

- **Demand** : Obligation to buy a fixed share of electricity produced by renewable technologies
  - 20 % target for Denmark for all renewables
  - The quotas will be fixed on beforehand by the energy authorities
- **Supply**: All renewables are certified for green electricity
  - A green certificate per MWh produced
- Pure financial market
- Possibility for international trade in certificates
- Feed-in tariff fixes the price - TGC-market fixes the volume



# Pro et cons

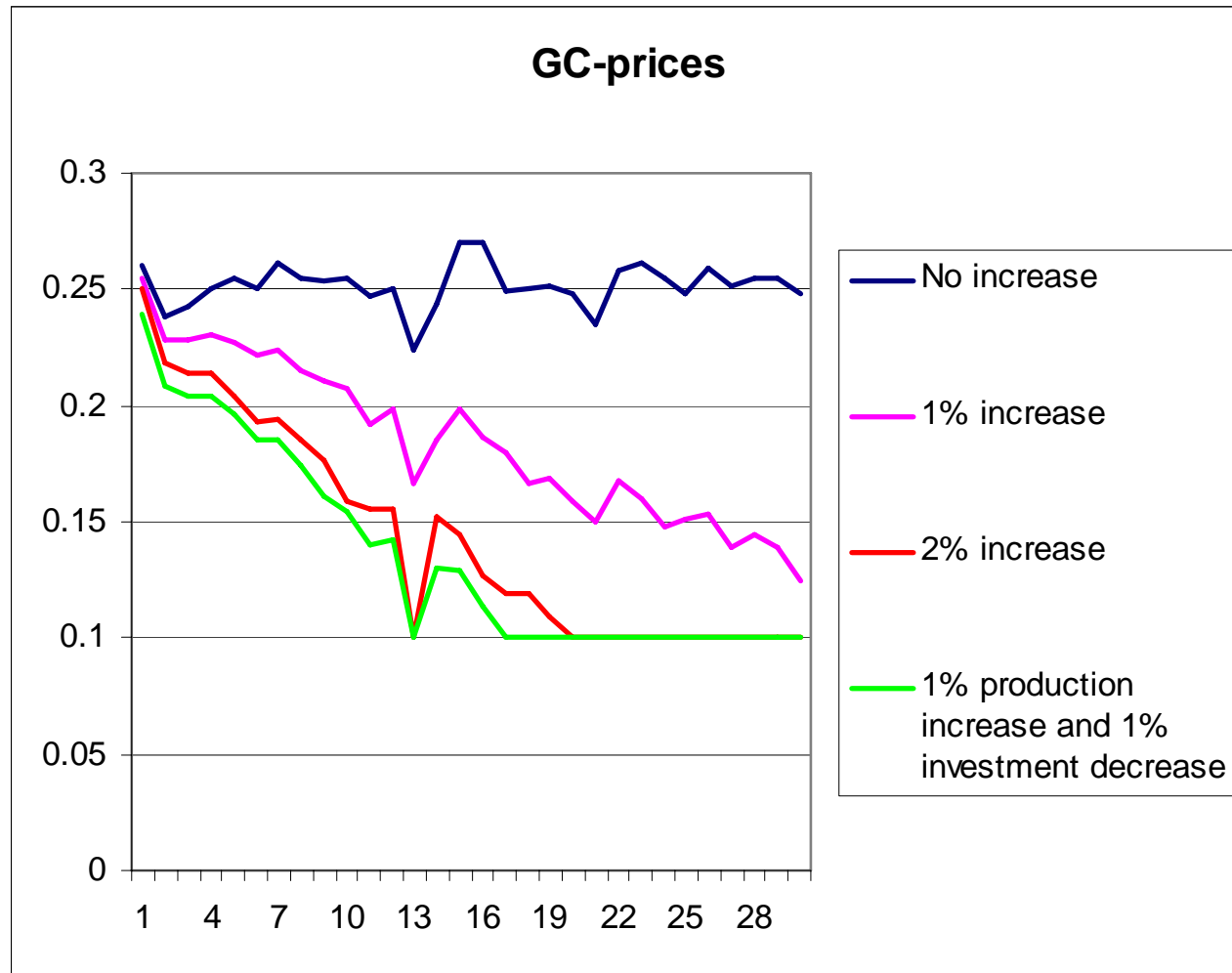
## Advantages

- Efficiency improvements show up in GC-prices directly
- Strong regulation of capacity development
- No governmental subsidisation - the consumers are going to pay
- International trade with green certificates is possible

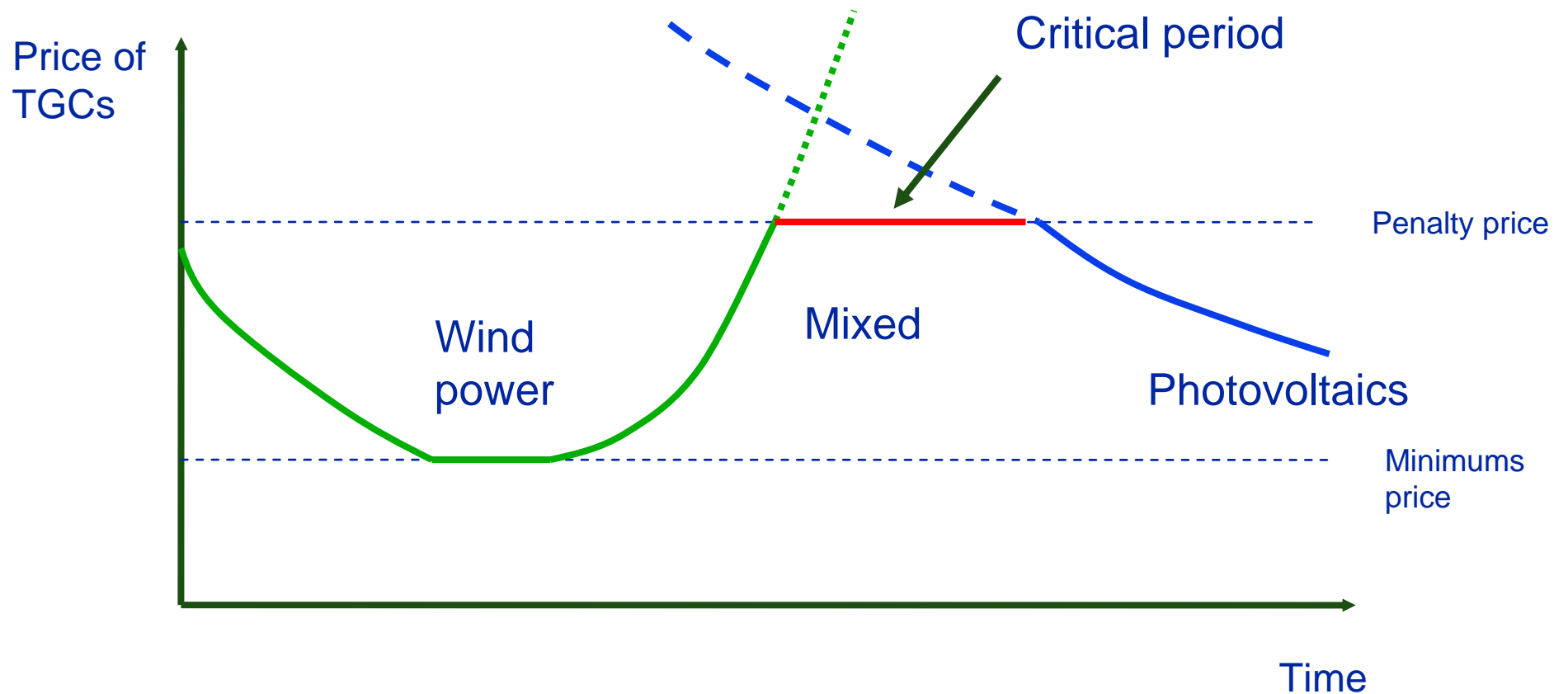
## Disadvantages

- Only the most competitive renewable technology is promoted
- The national market should have a minimum volume
- Higher investment risk: The GC market comprises *both* market risk and reliability of politicians
- How will green certificates interplay with other greenhouse gas reduction instruments?

# Dependence of efficiency increase



# Development of certificate prices

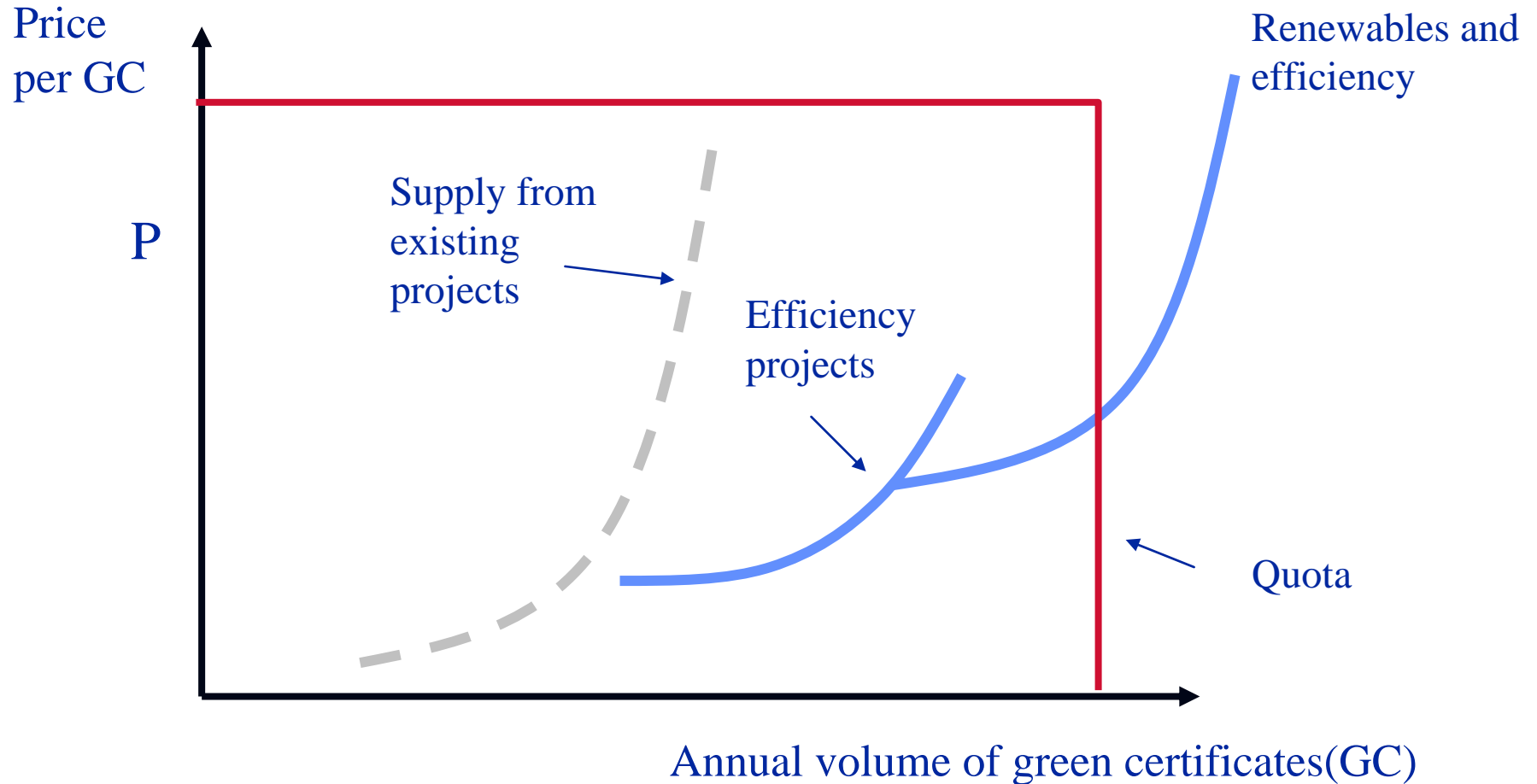


# Characteristics for an energy efficiency certificate market

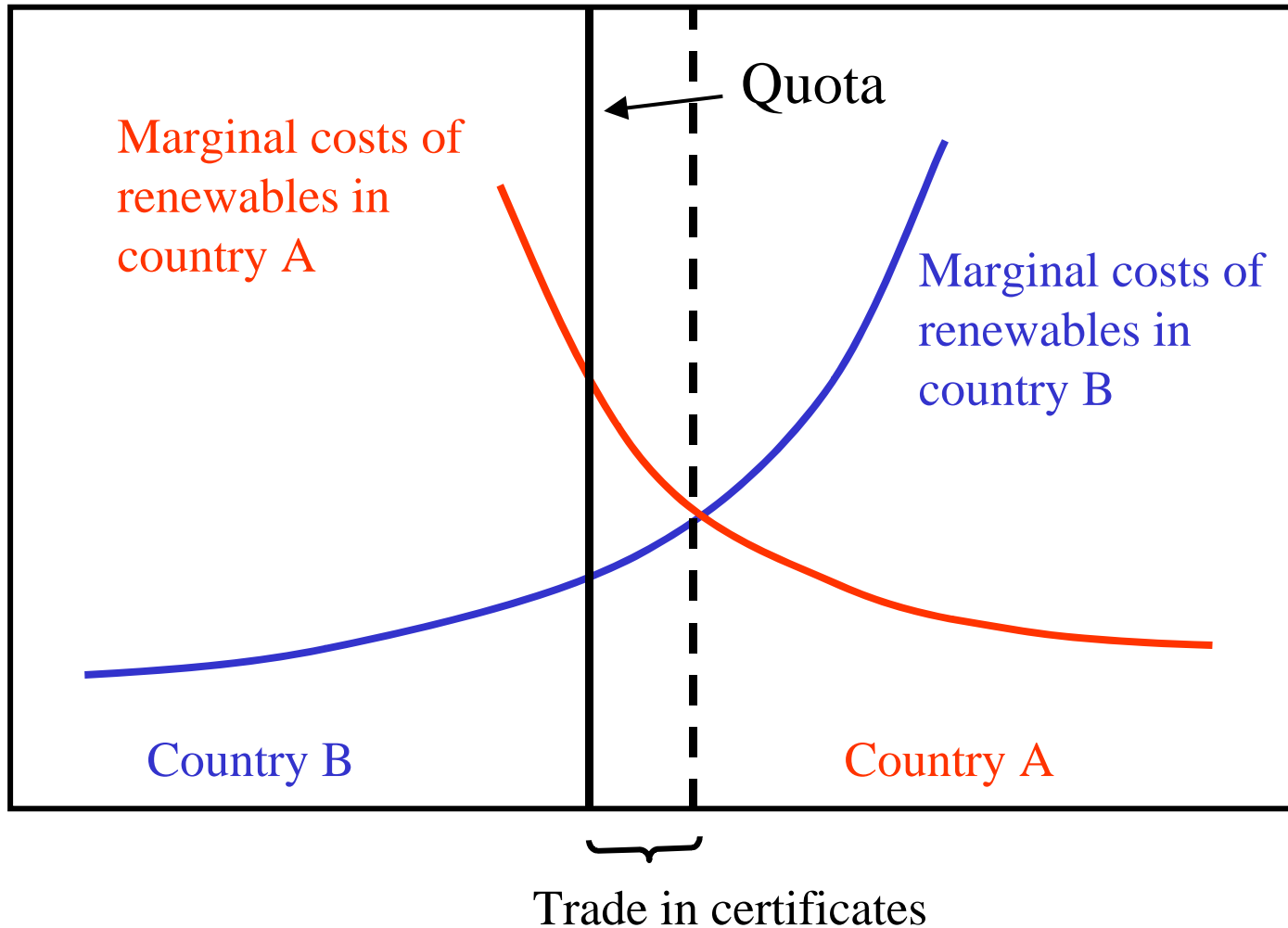
In principle the same as for a renewable certificate market

- **Demand** : Obligation to buy a fixed amount of certificates from energy efficiency projects
- **Supply**: Energy efficiency projects certified for supplying certificates
- Pure financial market
- Can be combined with the green market for renewables
- Monitoring and certification becomes more important than for the renewable system

# Combining a renewable and an energy efficiency certificate market



# International trade in certificates



# Certificate markets and CO<sub>2</sub>-reduction

- Contribute nationally by promoting renewables and energy efficiency projects
- Problems if international trading schemes are developed
  - Normally no CO<sub>2</sub>-credit is attached to certificates
  - Possible but difficult to fix the amount of CO<sub>2</sub>-reduction
- International certificate schemes only contribute to achieving renewable targets (and energy efficiency targets if these are included)
- A remedy is to combine the international certificate system with an emission trading scheme

# Conclusions

- In a national (closed) system a certificate system can be efficient in developing renewables
  - Most efficient in fairly large systems
- It seems possible to establish combined certificate markets for renewable and energy efficiency projects
  - Monitoring of efficiency projects are highly important
- International trade in certificates does not contribute in achieving national emission reduction targets
- A remedy to this problem is obtained by combining the certificate system with an emission trading scheme