TGC in Flanders. Analysis and Results.

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Aviel Verbruggen
University of Antwerp

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Figure 1: Number of Assigned certificates Jan.2002 - May 2005

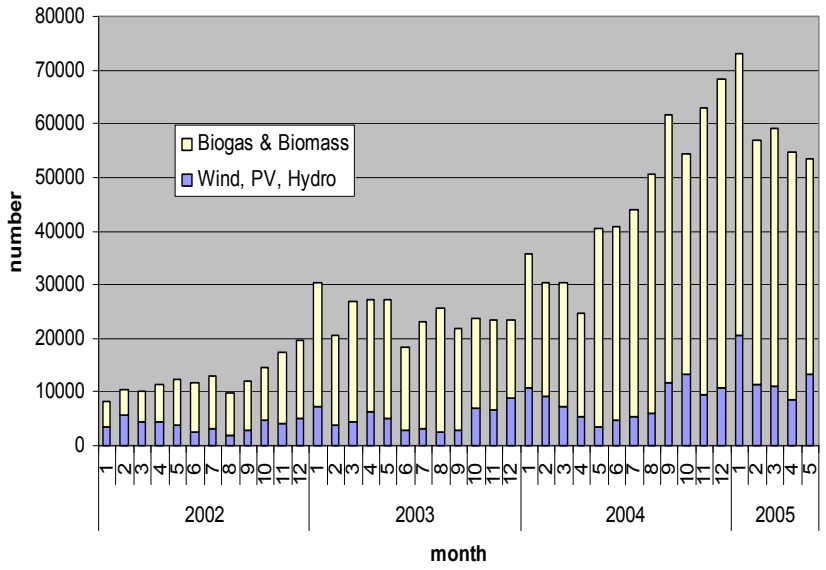


Figure 2: Shares of the technology classes in Assigned certificates Jan.2002 - May 2005

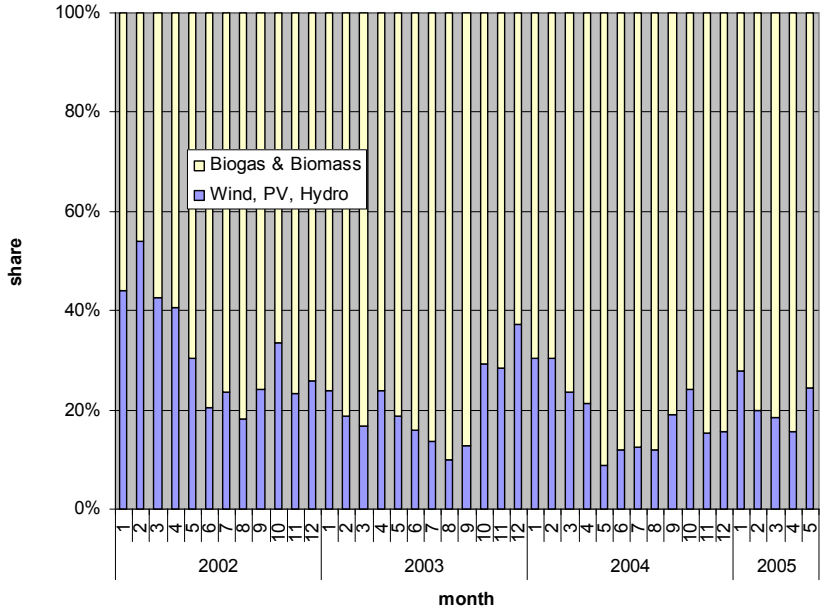


Figure 4: Windpower in Flanders: monthly assignment of certificates (Jan.2002-May2005)

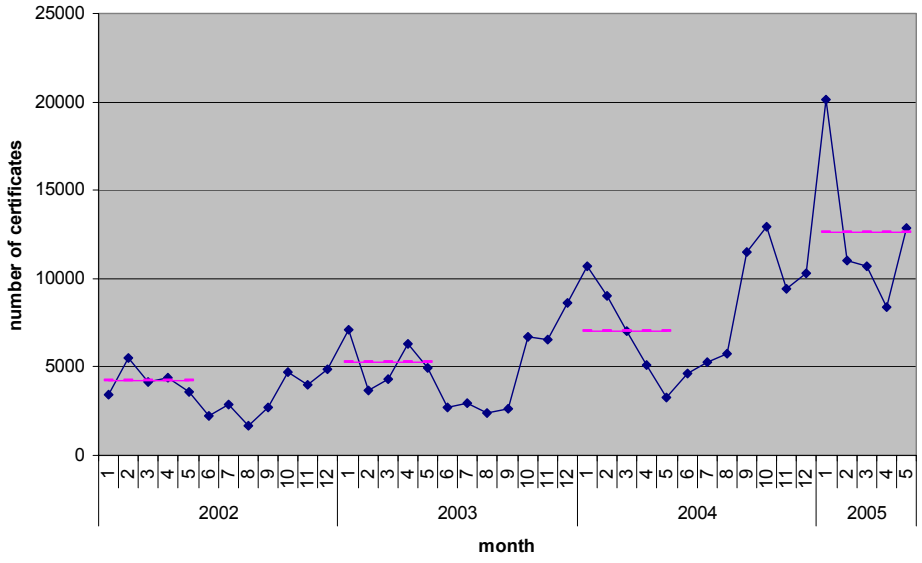


Figure 5: Approximate split of assigned certificates in the years 2002-2004 over OLD and NEW capacities

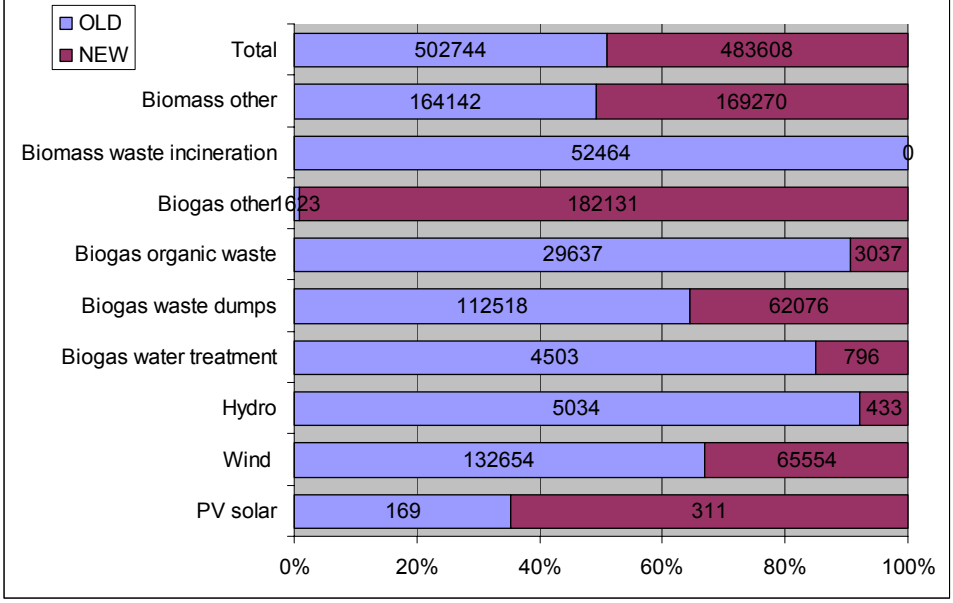


Figure 6: Traded volumes and prices (Jan.2004-May 2005)

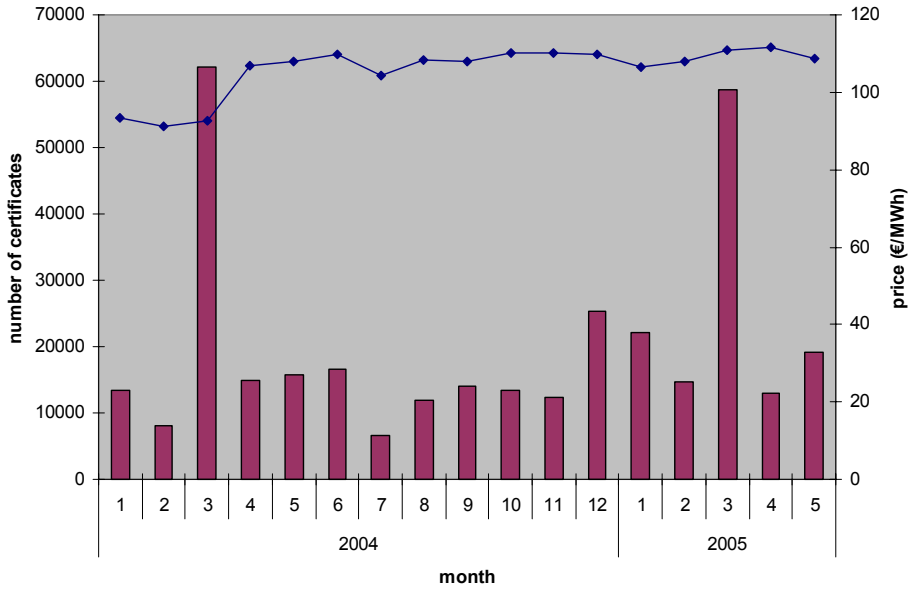


Figure 7 :How liquid is the trade?

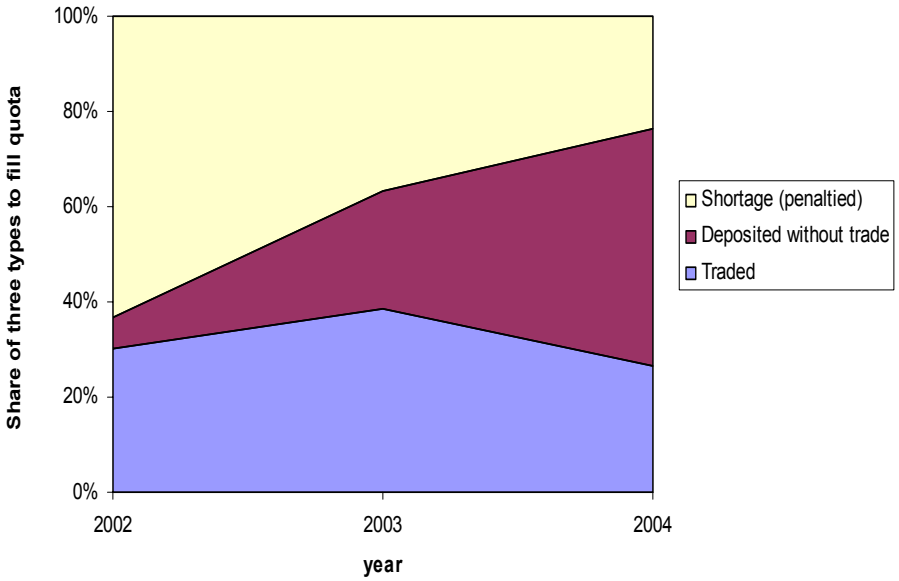
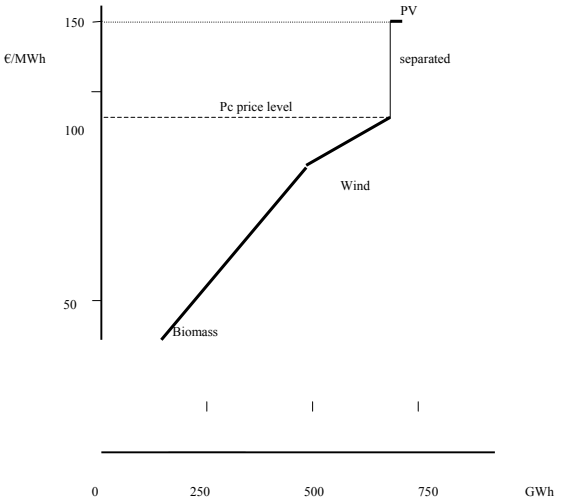


Figure 8: TGC supply curve (Flanders)



Green Power Investor Logic (1)

NPV (i,n) > 0

Over a period of n years, a return of at least i% per year is required

PV{revenues} - Initial Investment > 0

PV{ Pe * Gr } - InInv > 0

where Pe = price of substituted or sold kWh

Gr = quantity of green power

Pe(t) and Gr(t) fluctuate with t (= short time interval)

Green Power Investor Logic (2)

Practical problems:

- **Pe(t) is the outcome of a non-sustainable system of power generation and delivery**
- **Gr(t) is not/little controllable for many RES-E**

Resulting in:

1. **Low, fluctuating en uncertain revenues**
2. **Investors prefer other investment projects**
3. **RES-E remains underdeveloped**

Public intervention

Three instruments:

1. **Add-on per kWh RES-E: Se (also called Feed-in)**
2. **Add-on per kWh via certificate: Pc**
3. **Investment subsidy: SubInv**

Changing the NPV formula to:

$$PV\{ [Pe + Se + Pc] * Gr\} - [InInv - SubInv] > 0$$

Levelised Certificate Price

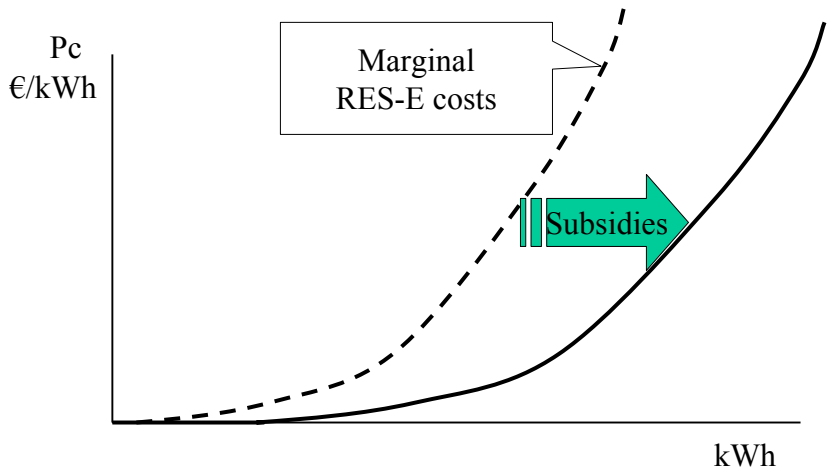
PV{Pc * Gr} = [InInv - *SubInv*] - PV{ [Pe + *Se*] * Gr}

Levelised price Pc (long-run supply price) =

$$\frac{\text{Net investment cost}}{\text{RES-E kWh}} - \frac{\text{Revenues from sales}}{\text{RES-E kWh}}$$

- **Certificates match with other instruments**
- **The supply of certificates depends on the fixings of the other instruments (Se and SubInv)**

TGC supply = amended marginal costs of RES-E deliveries



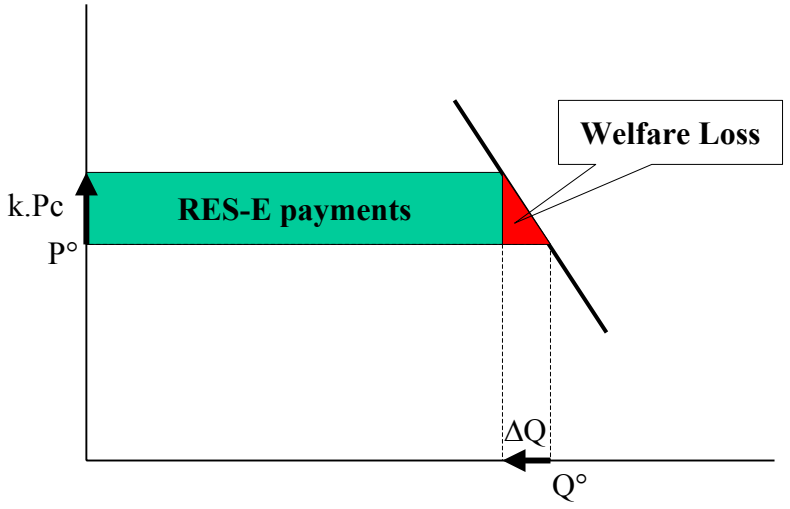
Demand for TGC

Double market:

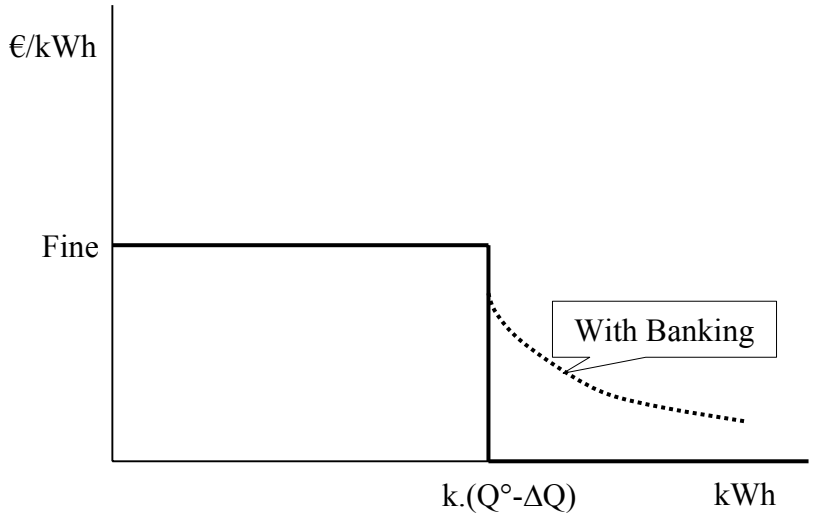
- **End-use electricity market (price ε of demand < 0, but unknown exactly)**
- **Electricity suppliers demand TGC for meeting the quotum**

Connection: suppliers bill the costs of TGC purchases + fines to end-users

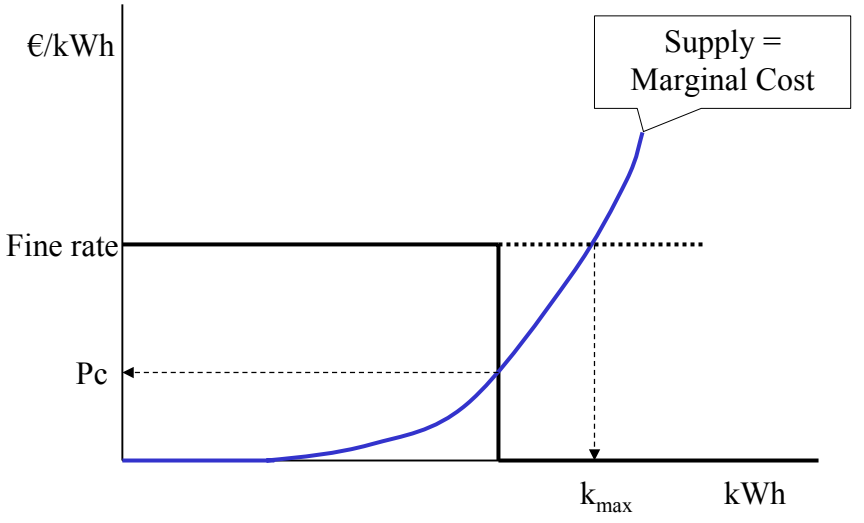
End-use Demand



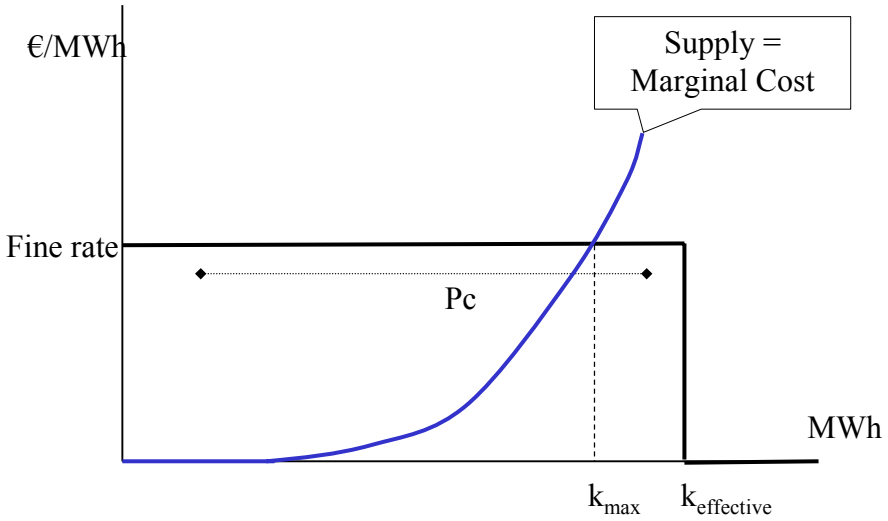
TGC demand by suppliers



TGC Market equilibrium



Flanders TGC Market



Conclusions: TGC instrument

- Flexible
- Effective for RES-E (when Pc < Fine)
- Compatible (closing) with other instruments
- Reduction in electricity end-use (depends on ε, k, Pc, but may become significant)
- Efficiency: either through market extension, or through optimal quota setting
- Information on Costs & Subsidies needed!

Besluit (1): credit

- Effectief voor HE ontwikkeling als Pc < Boete / MK=Boete voor punt k.[Q°-ΔQ]
- In dit geval ook flexibel [Pc is gevolg van vraag en aanbod]
- Compatibel met andere instrumenten
- Reductie van El.eindvraag: afhankelijk van ε, k, Pc, maar significant. Dwz: de sector betaalt de eigen transitie naar duurzaamheid

Besluit (2): debet

- Extra transactiekosten door additioneel instrument
- Effectiviteit begrensd tot Pc<Boete interval
- Toeslag op elektriciteitsprijs => verzet van eindgebruikers
- Kans op hoge ‘windfall’ winsten voor rijpe technieken / ‘free riding’ op het systeem

Besluit (3): hoe verbeteren?

Marktsegmentatie is nodig omdat HE een verzamelnaam is [cfr. voeding], bv.

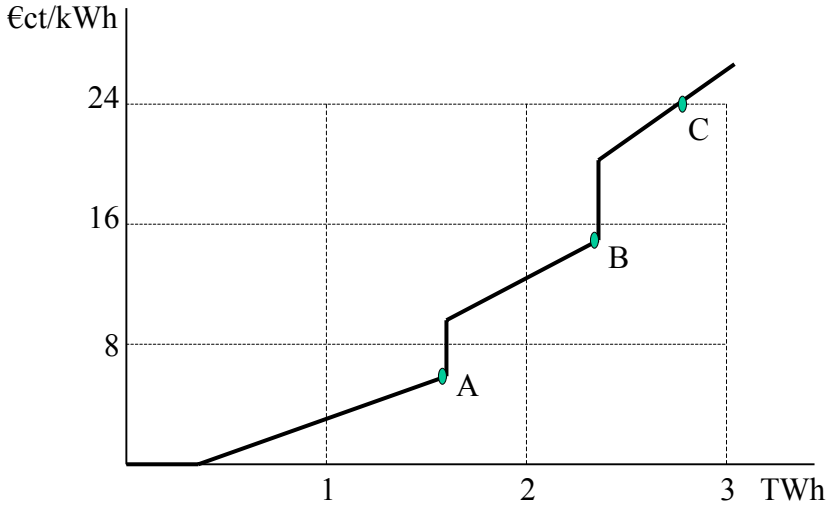
* afzonderlijke quota/boetes per HE type (dunne markten)
* toekennen gewichten aan HE types
* MK curven v/d verschillende HE types "masseren" om windfalls te vermijden

Uiterst nauwkeurige (en steeds actuele) kennis v/d MK curven v/d HE types is nodig.

Remaining Question:

WHAT
is the
ADDED VALUE
of a
CERTIFICATE SYSTEM?

Simulation results: GTC supply



Simulation results: numbers

	Wind A	Biom. B	PV. C
k (% of sales)	3,25	5	6
Fine €/MWh	60	150	240
End-use TWh	-0,4	-1,5	-2,9
RES-E TWh	1,6	2,4	2,8
GC-trade M€	96,7	364	680
Welfare M€	-0,38	-5,63	-20,7