



UNIVERSITY OF SPLIT
FACULTY OF
ELECTRICAL ENGINEERING,
MECHANICAL ENGINEERING
AND NAVAL ARCHITECTURE

Wind Energy in South-east Europe:
Seminar III: WIND ENERGY PROJECT DEVELOPMENT

Wind Project Development in Croatia

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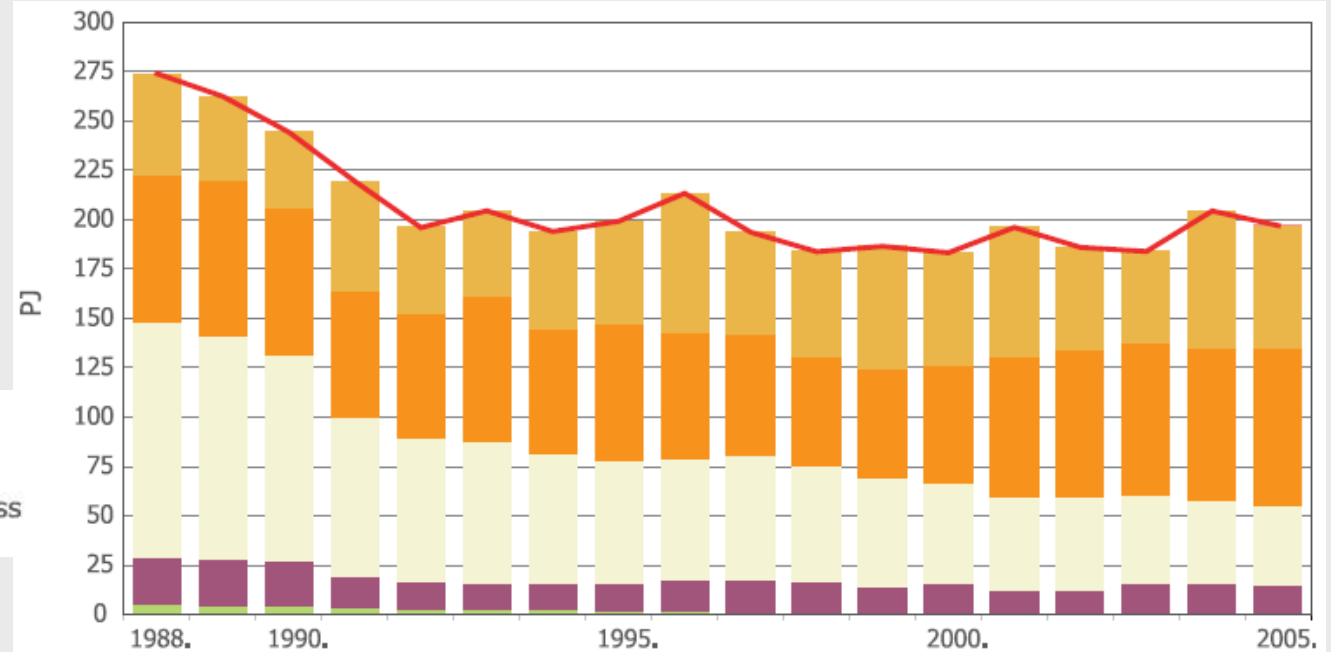
1. Current energy situation in Croatia

- Generation mix and electric energy balance
- Regulatory framework: main energy laws, sub-laws and technical codes
- Main energy related institutions in Croatia and their role: Ministries, HEP Group and subsidiaries, Regulatory Agency, Market Operator, Local authorities

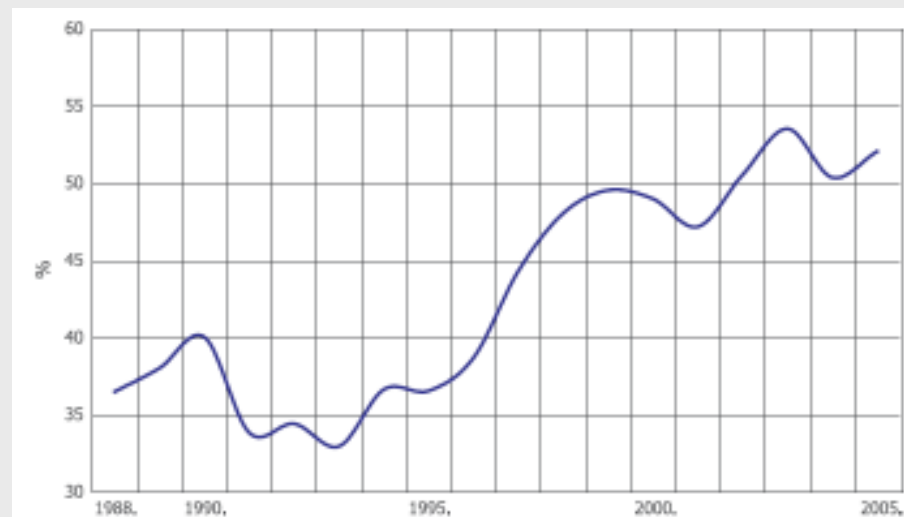
Generation mix and electric energy balance in Croatia (1)

Primary energy production

- Vodne snage - Hydro power
- Prirodni plin - Natural gas
- Sirova nafta - Crude oil
- Drvo i biomasa - Solid biomass
- Ugljen - Coal

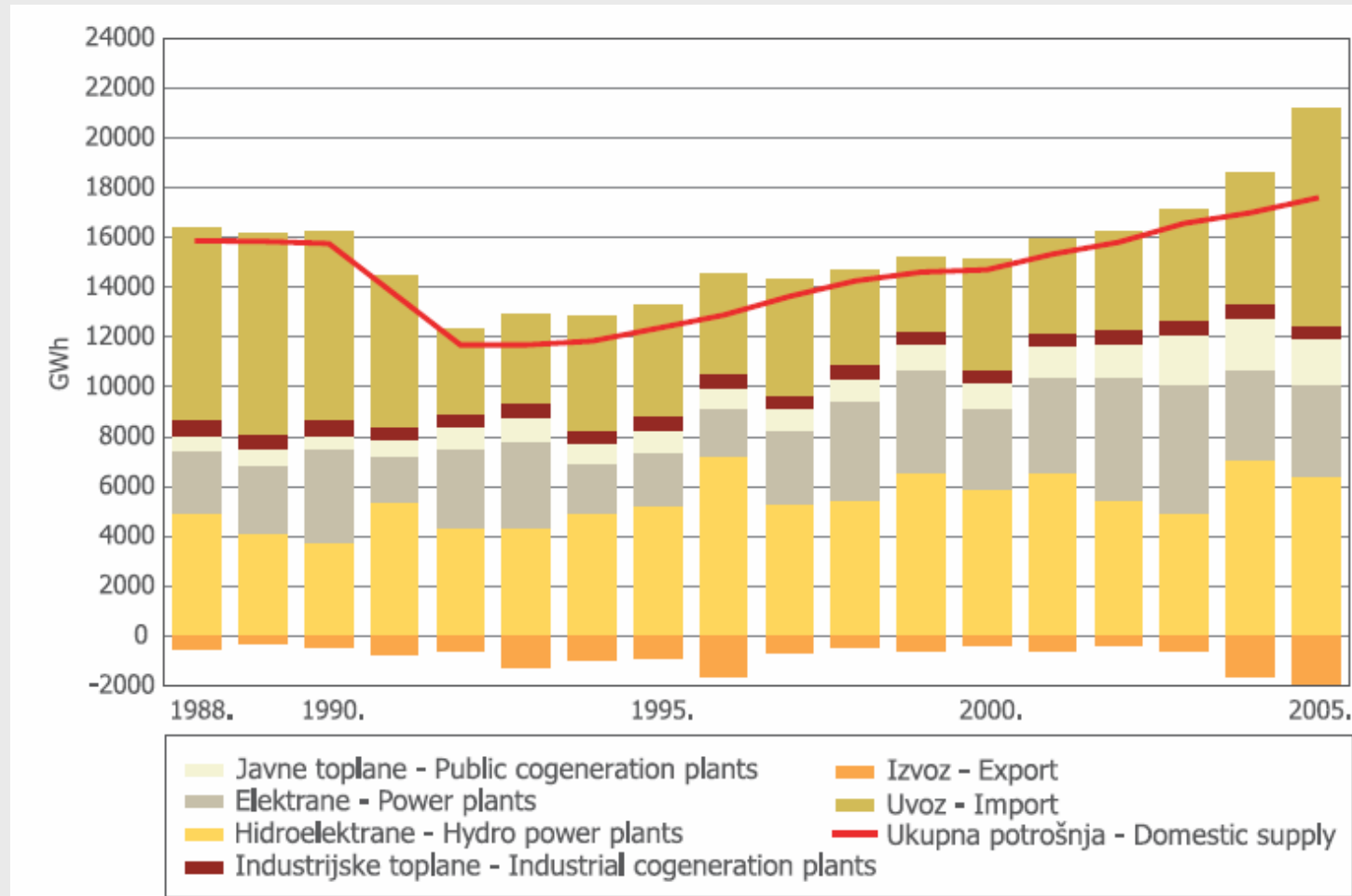


Energy import dependency



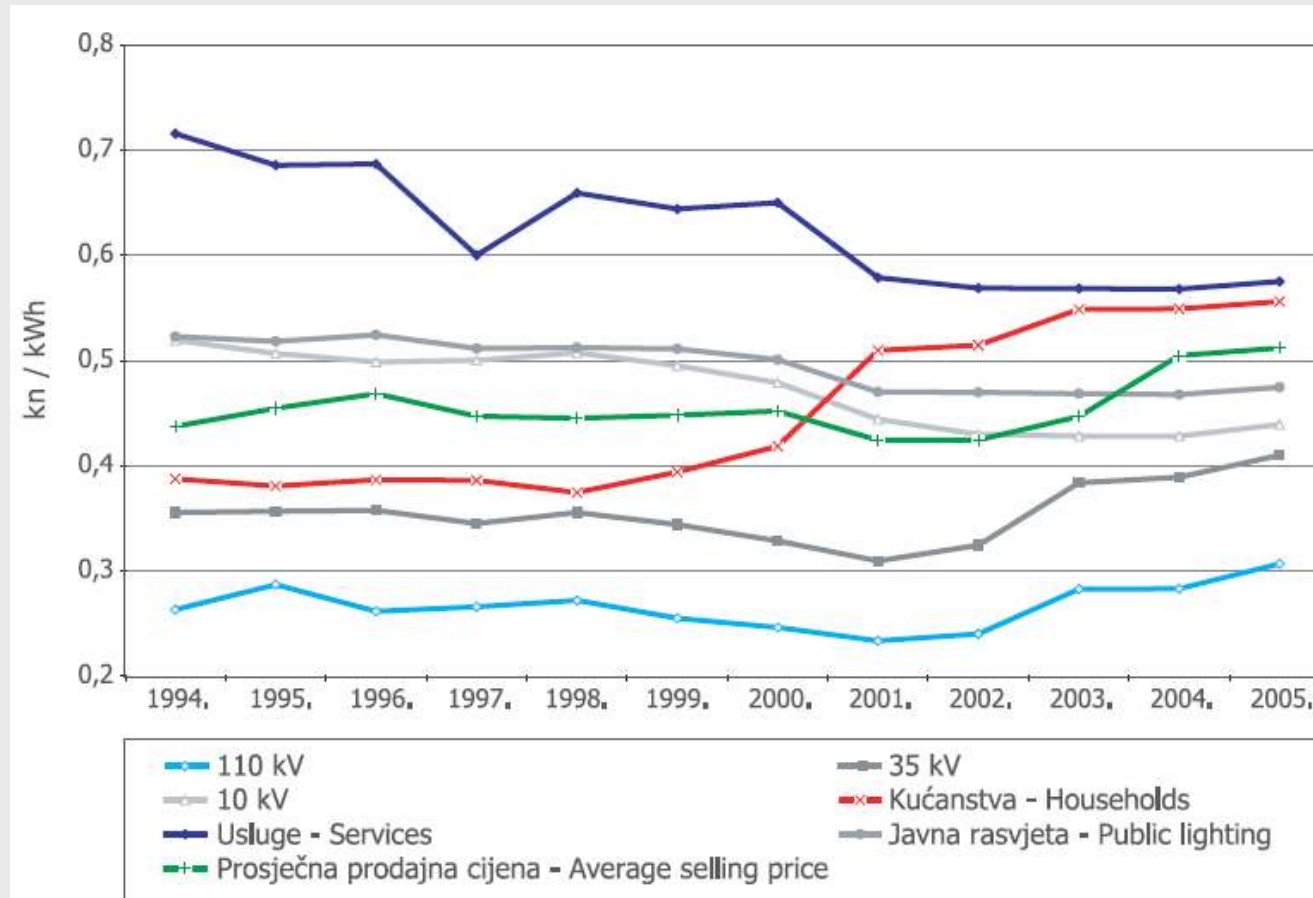
Generation mix and electric energy balance in Croatia (2)

Electricity balance



Generation mix and electric energy balance in Croatia (3)

Electricity prices
(excluding VAT, including inflation - 2005. basis, 1€=7.4kn)



Average selling price in 2005: 7 €c/kWh + VAT

Regulatory framework (1)

Basic energy laws:

- **The Energy Law**
 - **The Law on the Regulation of Energy Activities**
 - **The Law on the Electricity Market**
 - **The Law on the Gas Market**
 - **The Law on the Petroleum and Petroleum Products Market**
 - **The Law on the Production, Distribution and Supply of Heat Energy**
- Entered in force in 2001., updated in 2004.
- Generally harmonised with EU legislative (but not complete!)
- Not implemented entirely (in practice) yet, mainly because of incompleting sub-laws and other obstacles

Regulatory framework (2)

Energy Sub-laws (secondary legislation) important for wind energy development:

- **Ordinance on the Use of RES and Cogeneration (not yet published)**
 - Specify RES to be used for energy production, conditions and possibilities for their use (type, technology)
- **Regulation on Minimum Share of Electricity Produced From RES and Cogeneration (published; in force from 7/2007)**
 - Specifies a minimal share of electricity produced from RES and cogeneration, which the supplier is obligated to purchase (to the end of 2010): 5.8% of total electricity consumption (900 GWh now, aprox. 1050 GWh in 2010)
- **Ordinance on the conditions/criteria for obtaining the status of an eligible (privileged) producer (not yet published)**
 - Stipulate the types of plants for granting the energy subjects the status of beneficial electric energy status, minimal conditions for granting the status etc...

Regulatory framework (3)

- **Tariff System for Electricity Production from RES and Cogeneration (published; in force from 7/2007)**
 - Determine the producer's right to an incentive price payable by the market operator for energy supplied (feed-in tariffs, 12 year duration)
- **Compensation (charge) for Providing Incentives for RES and Cogeneration (published; in force from 7/2007)**
 - Cost coverage of the market operator in view of implementation of the tariff system for RES generation and cogeneration: final customer pays additional ~ 1.7% in 2007 and 6.7% in 2010

Mix of quota and feed-in system + authorization for power plant building

Regulatory framework (4)

Renewables feed-in tariffs:

<u>Up to 1MW installed power</u>		
	kn/kWh	€/kWh
Photovoltaic (depending on size)	2.10-3.40	28.38-45,95
Hydro	0.69	9,32
Wind	0.64	8,65
Biomass from forestry and agriculture	1.20	16,22
Biomass from wood industry	0.95	12,84
Geothermal	1.26	17,03
Liquid biofuels	0.36	4,86
Landfill gas and facilities from wastewater treatment	0.36	4,86
<u>Over 1MW installed power</u>		
	kn/kWh	€/kWh
Hydro (up to 10MW installed power, depending on annual production)	0.42-0.69	6.68-9.32
Wind	0.65	8,78
Biomass from forestry and agriculture	1.04	14,05
Biomass from wood industry	0.83	11,22
Geothermal	1.26	17,03
Liquid biofuels	0.36	4,86
Landfill gas and facilities from wastewater treatment	0.36	4,86

Note: Prices are given for 100% “domestic components” used for equipment (penalization up to 7%)

Regulatory framework (5)

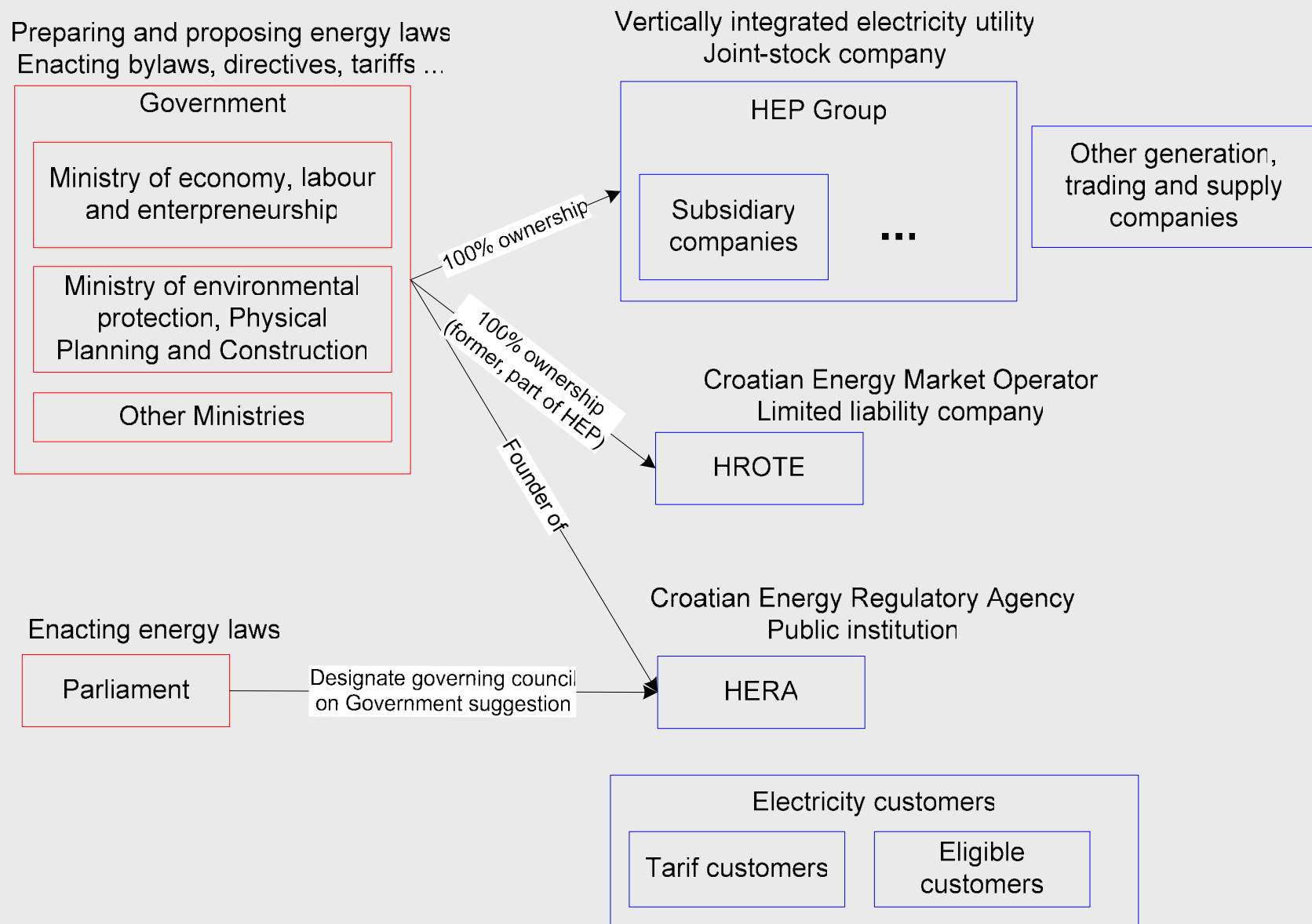
A) Sub-laws / technical codes for network connection and use (all in force)

- **Grid Code**
 - ◉ technical conditions and rules for network connection on transmission and distribution network
 - ◉ annex for wind power plants in preparation
- **General conditions for electric energy supply**
 - ◉ procedure and rules for obtaining preliminary and final network connection permit
 - ◉ procedure and rules for network usage agreement
- **Network connection charges**
 - ◉ principles for determining network connection charges
 - ◉ tariffs for network connection

B) Other (very!) important laws

- Spatial (physical) planning law
- Environmental protection law
- Building law
- (Concession law ?)

Main energy related institutions in Croatia



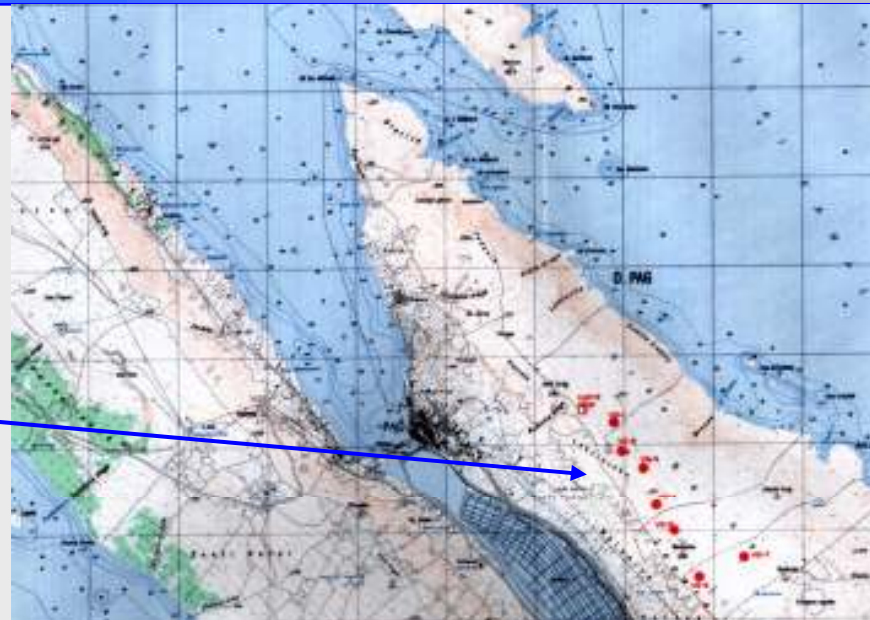
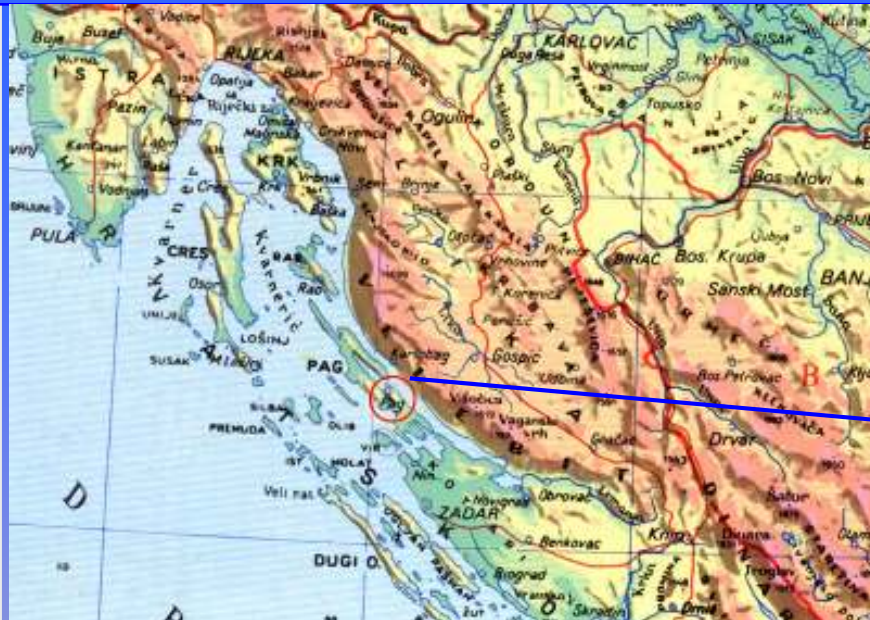
2. Brief history of wind development in Croatia

- History and future
- Example of wind characteristics

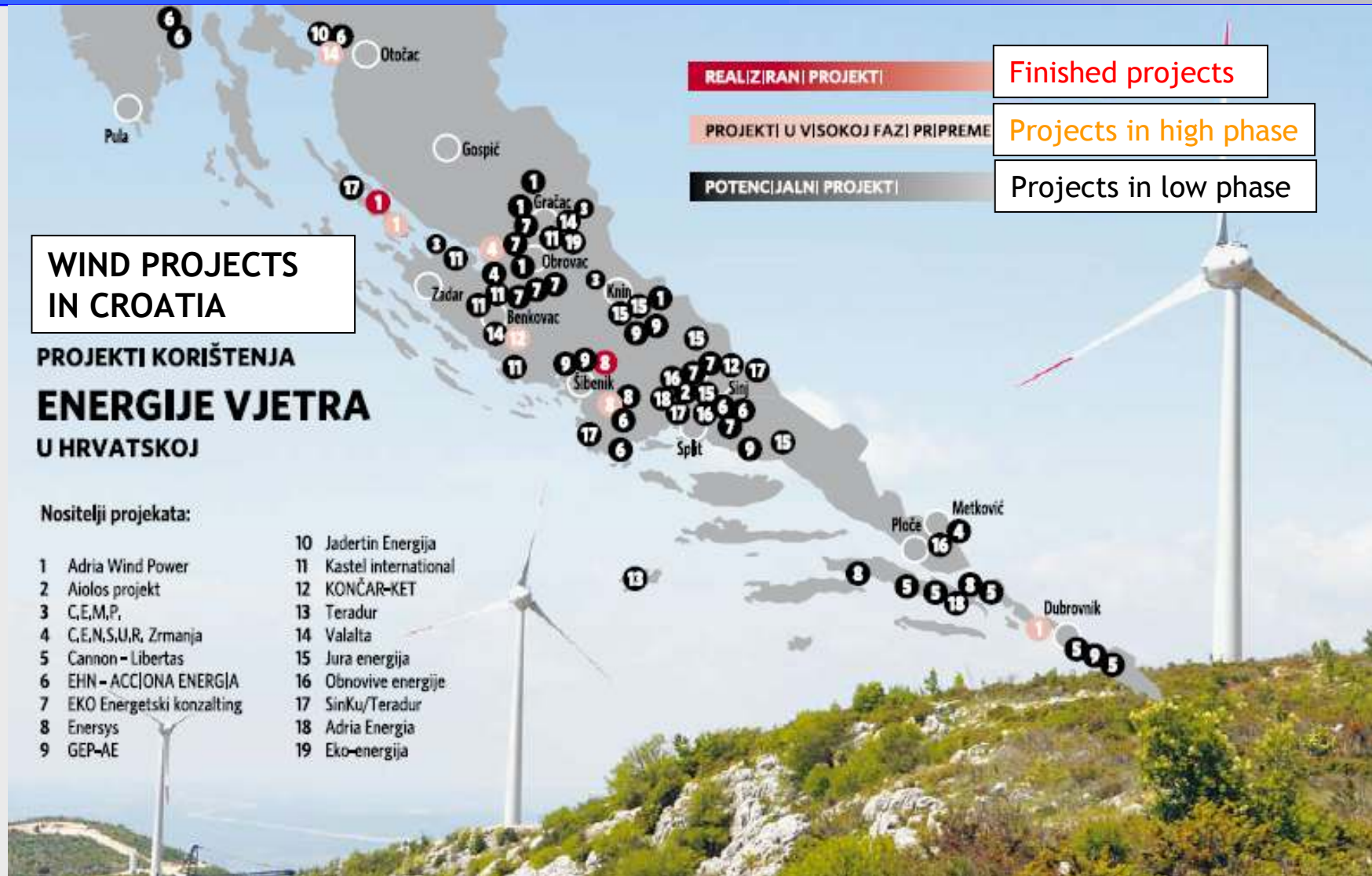
History and future (1)

- Early stage (up to 2001): No success
- After 2001 (2001 till now)
 - Waiting for energy sub-laws
 - Expansion of developers activities
 - Two isolated successful case:
 - ⦿ Wind park Ravne (Pag island), 5.95 MW, 7x850 kW Vestas
 - ⦿ Wind park Trtar-Krtolin (near Šibenik), 11.2 MW, 14x800 kW Enercon
 - ⦿ both build on basis of old legislative framework!
- Future (after completing energy sub-laws, probably during this year):
 - Optimistic expectations on long-term basis: good wind conditions on many locations
 - Constrained on short-term basis imposed by mixed quota/feed-in system and network restrictions
 - Expecting aprox. 400 MW till end of 2010

History and future (2)



History and future (3)

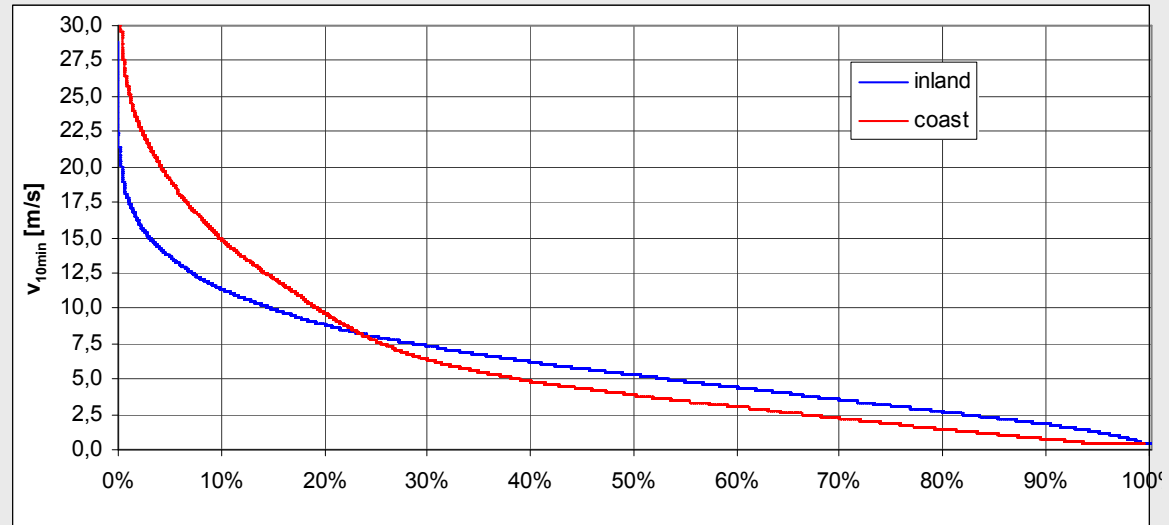


Note: This is picture from one newspaper before 6 months (there are more developers and locations...)

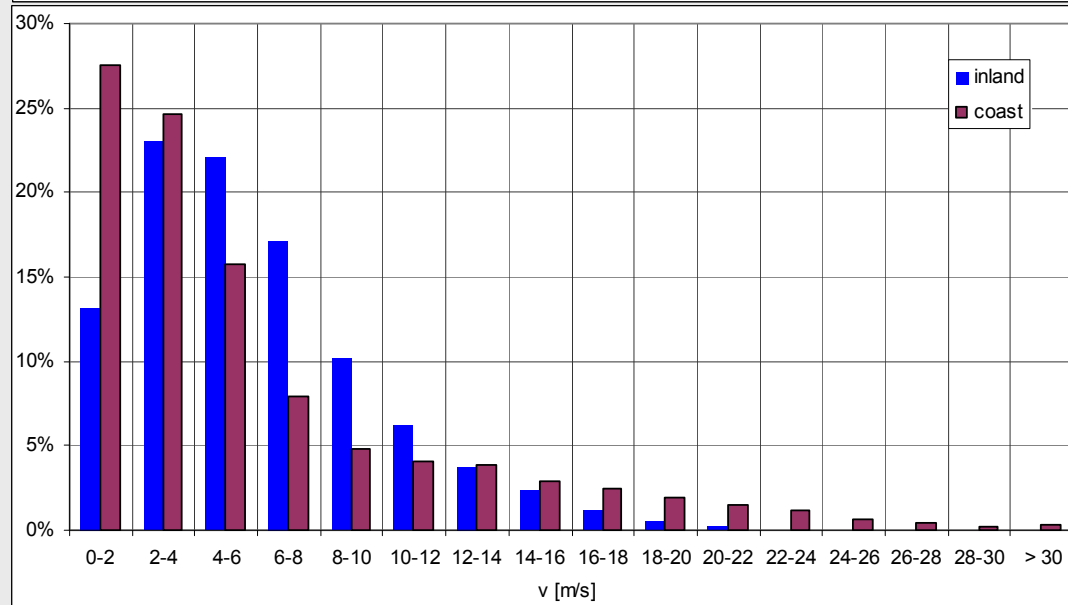
Example of wind characteristics in Croatia (1)

Comparison of measurement wind data for inland and coastal wind farm location

Wind duration curve

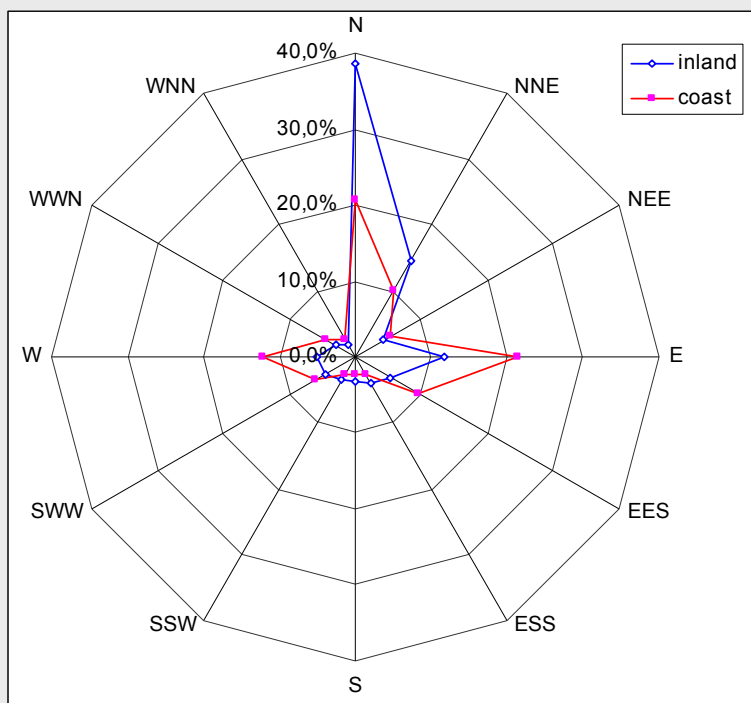


Wind frequency

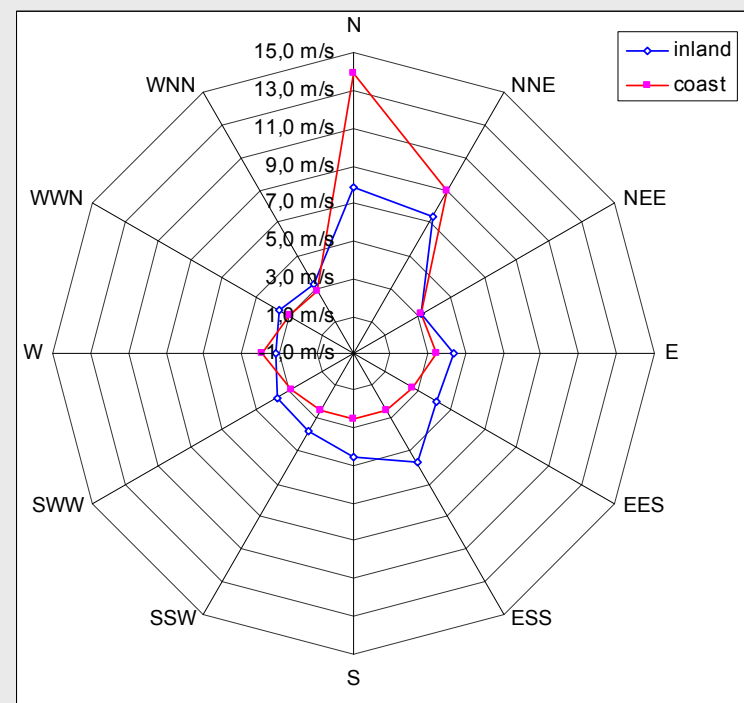


Example of wind characteristics in Croatia (2)

Direction



Average speed



	Inland	Coast	
v_{avg} (50m)	5,98	5,95	m/s
v_{max} (50m)	36,7	48,1	m/s
P/A_{avg} (50m)	320	714	kWh/m ²
$W/A_{avg/annual}$ (50m)	2800	6260	kWh/m ² /year
Production factor (80m)	27,5	23,5	%

3. Legal procedure for building approvals

- Local spatial plans as necessary condition
- Location permit
- Preliminary approval for power plant building
- Preliminary status of eligible producer
- Licence for electricity generation
- Final approval for power plant building
- Building permit
- Power purchase agreement and Network usage agreement
- (Building...)
- Technical inspection, usage permit and trial operation
- Final status of eligible producer

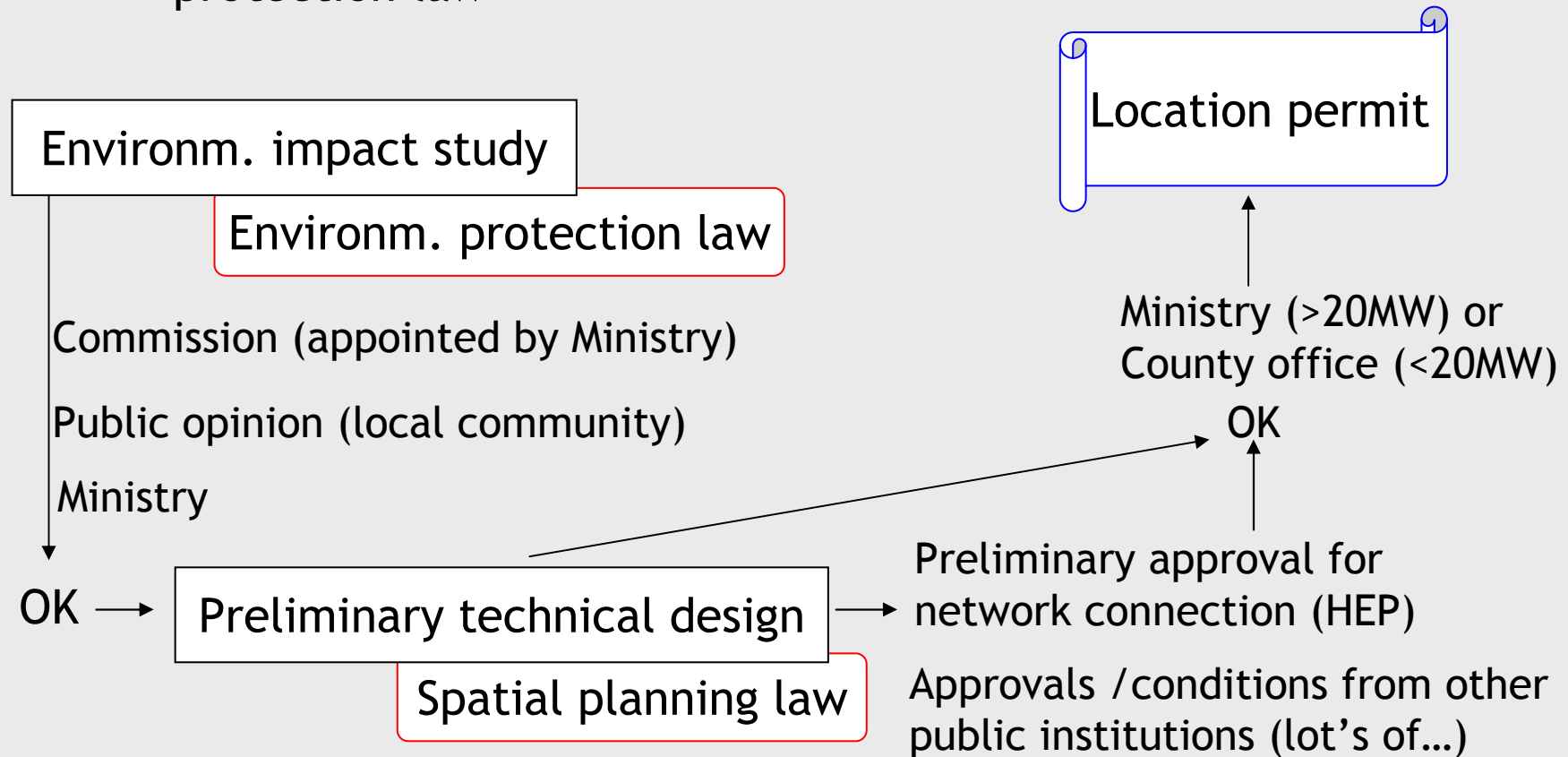
Local spatial plans as necessary condition

- Local spatial plans:
 - County (district) spatial plan
 - Municipality spatial plan
 - Area for wind park have to be marked in both plans as necessary condition for obtaining location permit!
 - If not, it is not possible to obtain any permit
 - Wind park have to be planned inside marked area
 - Plans are updated occasionally (not often than 5 years)



Location permit

- Location permit (key document!)
 - declare possibility for building (any type of object) on exactly defined area, including all conditions/constraints
 - based on Spatial (physical) planning law and Environmental protection law



Preliminary approval for power plant building

- Ministry of economy, labour and entrepreneurship give preliminary approval for power plant building (any type):
 - based on **Law on the Electricity Market, Article 9-4**
 - detail procedure for this approval will be included in sub-law **Ordinance on the Use of RES and Cogeneration (not yet published)**
 - necessary conditions (from proposal):
 - ⦿ positive local community opinion
 - ⦿ network connection study (for plants > 50MW)
 - preliminary approval for plant building is necessary condition for:
 - ⦿ legal start of measurement activities on site
 - ⦿ registration in Renewable Projects Registry
 - different procedure for:
 - ⦿ developers which already have measurement site(s) - “existing projects”
 - ⦿ new developers (sites) - “new projects”

Approval for measurement site

- (Government) Office for State Property Management gives approval for using land for installing measurement equipment
 - only if land is in State ownership
 - measurement equipment (tower) have to be certified
 - preliminary approval for wind park building is necessary condition
- On private land, approval is obtained from owner

Preliminary status of eligible producer

- Croatian Energy Regulatory Agency (HERA), on developer's request, issue a document - Preliminary status of eligible producer
 - detail procedure will be included in sub-law **Ordinance on the conditions/criteria for obtaining the status of an eligible (privileged) producer (not yet published)**
 - Necessary conditions (from proposal):
 - preliminary technical design of wind park
 - preliminary environmental impact assessment

Licence for electricity generation

- Croatian Energy Regulatory Agency (HERA), on developer's request (company registered in Croatia), issue a document - Licence for electricity generation
 - based on **Law on the Electricity Market, Article 16**
 - detail procedure defined in sub-law **Ordinance on conditions for pursuit energy activities:**
 - Technical, financial and professional qualifications of company have to be settled
 - Different procedure for:
 - ◎ "old" energy company which is owner of some energy facilities
 - ◎ "new" energy company

Final approval for power plant building

- Ministry of economy, labour and entrepreneurship give final approval for power plant building (any type):
 - based on **Law on the Electricity Market, Article 9-4**
 - detail procedure for this approval will be included in sub-law **Ordinance on the Use of RES and Cogeneration (not yet published)**
 - from proposal:
 - ⦿ valid location permit
 - ⦿ other conditions from preliminary approval
 - ⦿ non-overlapping with other site (developer)
 - with final approval for wind park building it is possible to agree using (renting) of State land for wind park
 - but, it is not really possible to start building (building permit is also needed)
 - final approval is valid 1 year (in that time building permit have to be obtained)

Building permit

- Building permit
 - based on Building law
 - issued by Ministry of environmental protection, Physical Planning and Construction or local county office (in jurisdiction of the same Ministry)
 - necessary conditions:
 - ◎ valid location permit
 - ◎ land ownership - sale or rent contract with owner
 - ◎ complete and detailed technical (project) documentation for building
 - ◎ Final approvals from many public institutions, including final approval and **network connection agreement**
 - after obtaining building permit, it is possible to start physical works on site
 - Building permit is valid 2 years

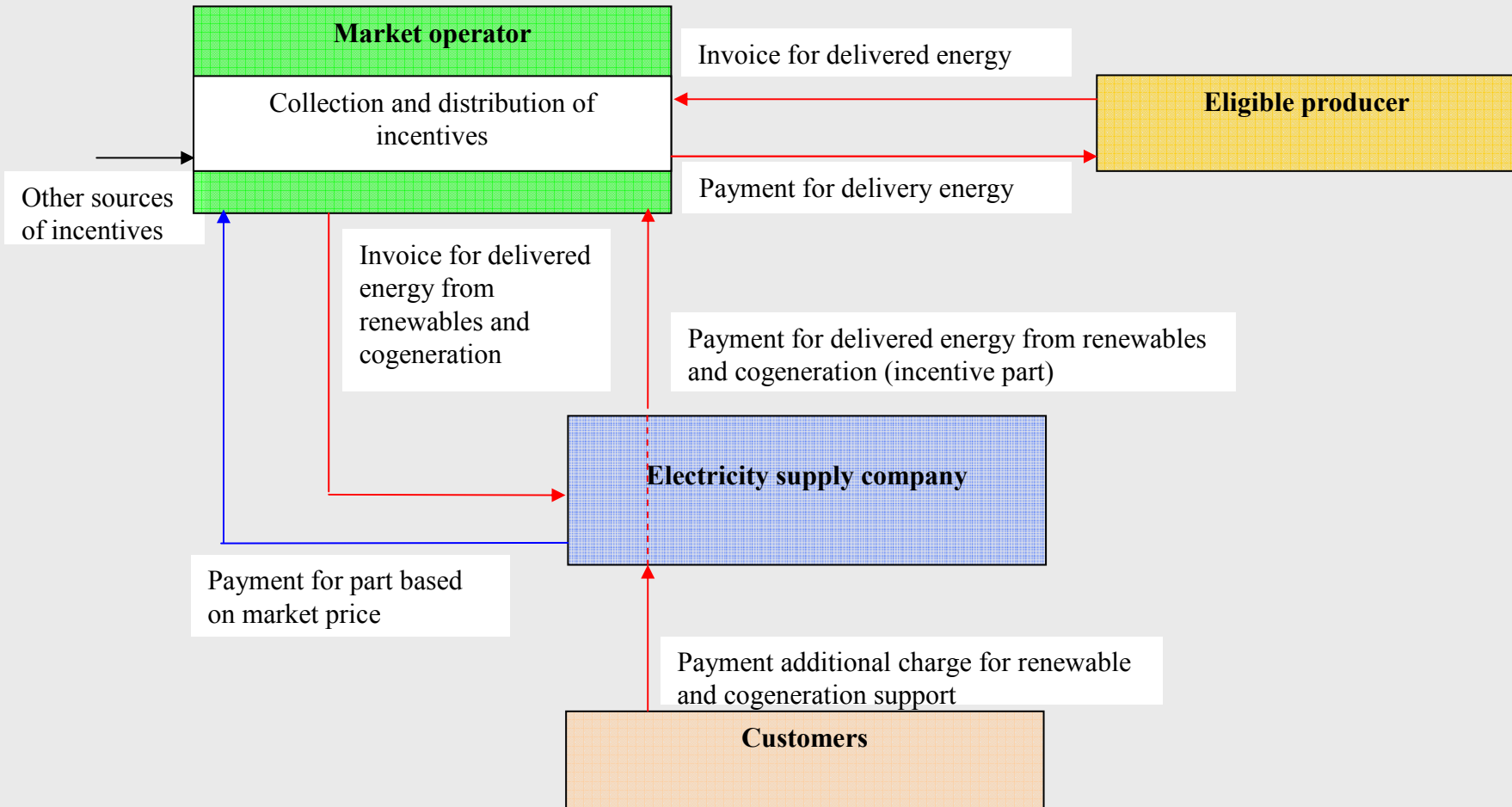
Note:

- beside wind park, location permit and building permit have to be issued for all objects necessary for network connection (transformer station, power lines...)
- for that permits are in jurisdiction of HEP

Power purchase agreement (1)

- Power Purchase Agreement
 - in jurisdiction of HROTE (Croatian energy market operator)
 - based on sub-law **Tariff System for Electricity Production from RES and Cogeneration (published; in force from 7/2007)**
 - 12 year duration
 - fixed feed-in tariff
 - Necessary condition: valid network connection agreement and building permit

Power purchase agreement (2)



Network usage agreement

- Network usage agreement
 - with HEP Transmission system operator (in case of connection on transmission network; >10MW)
 - with HEP Distribution system operator (in case of connection on distribution network)
 - based on sub-laws **General conditions for electric energy supply (published; in force from 4/2006)**
 - Necessary conditions:
 - ⊙ valid network connection agreement
 - ⊙ payed connection charges

Technical inspection, usage permit and trial operation

- Usage permit
 - based on Building law
 - issued by Ministry of environmental protection, Physical Planning and Construction or local county office (in jurisdiction of the same Ministry)
 - necessary conditions:
 - ⊙ Finished construction of object
 - ⊙ Committed technical inspection (with certificate that object is build according to specification from building permit)
 - for that permits are in jurisdiction of HEP
- Trial run
 - based on Grid code:
 - ⊙ inspection of accomplishment of proposition from network connection agreement (technical part)
 - ⊙ Inspection of accomplishment of Grid code requirements

Final status of eligible producer

- Croatian Energy Regulatory Agency (HERA) issue a document - Final status of eligible producer
 - detail procedure will be included in sub-law **Ordinance on the conditions/criteria for obtaining the status of an eligible (privileged) producer (not yet published)**
 - Necessary conditions (from proposal):
 - ⦿ Valid location, building and usage permit, successful technical inspection and trial operation
 - ⦿ Generation plan (estimation of monthly production during next year and shutdown periods)

The End

- Thank you for attention
- Questions?