

# **SHP – facts and how to cope with**

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## Contents

- Statistical data & their uncertainty
- Incentives and barriers
- Engineering process
- Additional requirements and skills
- Environmental aspects

## **Statistical problems**

- European SHP defined by  $N < 10$  MW
- Different source quality of data (official, private)
- Different time of updating
- Obligatory registration only with „feed in“ situation
- In small SHP (<100 kW) data often not available
- Public availability of data (national data protection)
- Completeness

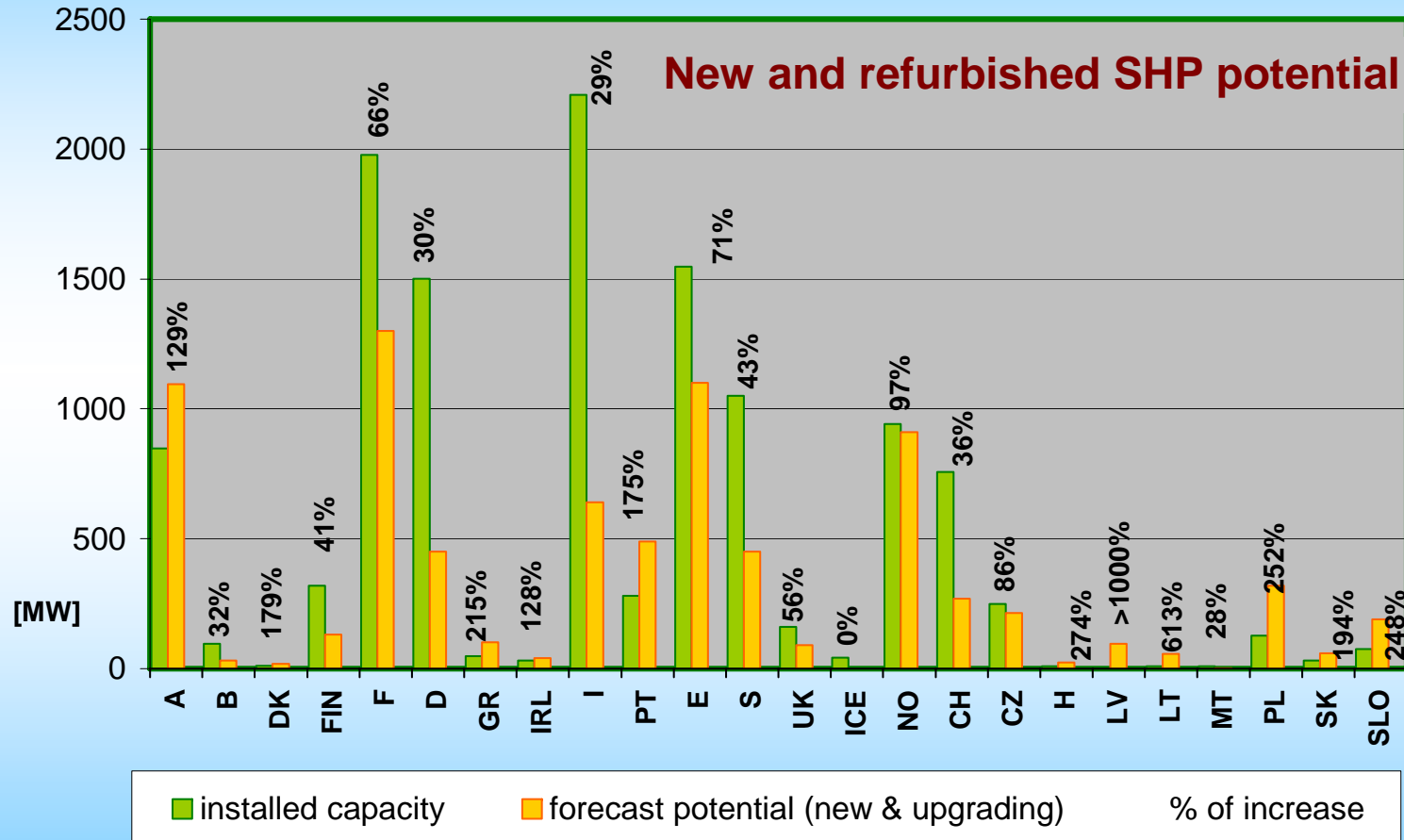
## SHP – Production in Europe 15

| Land           | MW           | GWh/a         | EW in Mio. | W/E          | Fläche           | kW/km <sup>2</sup> |
|----------------|--------------|---------------|------------|--------------|------------------|--------------------|
| Belgien        | 59           | 204           | 10,3       | 5,73         | 30.500           | 1,93               |
| Dänemark       | 11           | 27            | 5,4        | 2,04         | 43.000           | 0,26               |
| Finland        | 304          | 1.328         | 5,2        | 58,46        | 337.000          | 0,90               |
| Frankreich     | 1.997        | 7.131         | 59,2       | 33,73        | 547.000          | 3,65               |
| Deutschland    | 1.418        | 6.277         | 82,5       | 17,19        | 357.000          | 3,97               |
| Griechenland   | 44           | 146           | 11         | 4,00         | 132.000          | 0,33               |
| Irland         | 55           | 112           | 3,8        | 14,47        | 70.000           | 0,79               |
| Italien        | 2.210        | 8.321         | 57,7       | 38,30        | 300.000          | 7,37               |
| Luxembourg     | 35           | 154           | 0,4        | 87,50        | 2.600            | 13,46              |
| Niederlande    | 2            | 1             | 16         | 0,13         | 41.500           | 0,05               |
| Österreich     | 848          | 4.246         | 8          | 106,00       | 84.000           | 10,10              |
| Portugal       | 247          | 566           | 10,2       | 24,22        | 92.000           | 2,68               |
| Spanien        | 1.506        | 5.231         | 39,5       | 38,13        | 505.000          | 2,98               |
| Schweden       | 936          | 4.448         | 8,9        | 105,17       | 450.000          | 2,08               |
| Großbritannien | 161          | 242           | 59,9       | 2,69         | 245.000          | 0,66               |
| <b>Gesamt</b>  | <b>9.833</b> | <b>38.433</b> | <b>378</b> | <b>26,01</b> | <b>3.236.600</b> | <b>3,04</b>        |

## **SHP – Production worldwide**

|                                     | 1980   | 1985   | 1990   | 1995   | 2000   | 2005   | 2010   |
|-------------------------------------|--------|--------|--------|--------|--------|--------|--------|
| EU installierte Leistung (MW)       | 5.900  | 6.700  | 7.700  | 9.000  | 9.600  | 10.300 | 12.000 |
| weltweit installierte Leistung (MW) | 19.000 | 21.000 | 24.000 | 27.900 | 37.000 | 46.000 | 55.000 |
| prozentueller Anteil der EU         | 31,05  | 31,90  | 32,08  | 32,26  | 25,95  | 22,39  | 20,00  |

## SHP – Potential in Europe



## What is potential? Theory versus reality

100% natural potential ( $Q \times H$ )

65% technical feasible

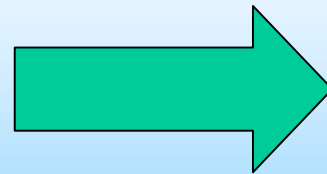
45% technical & economical feasible

30% technical & economical & environmental feasible

All decisive parameters have a time variability !!

## **Political will**

- International committment (in European Union: RE directive)
- International discipline (Kyoto protocol)
- National economical targets (energy independency)
- National public pressure (newspapers, elections, etc)
- Regional development plans



## **Legislational Framework**

- Granting procedure (concentration vs diversity)
- Water rights (unlimited vs bidding system)
- Environmental law (restrictive vs consensous)
- Energy law (supportive vs prohibitive)
- Energy pricing (high vs low)



## **Environmental restrictions**

### **1. General non-specific restrictions**

International groups (WWF, greenpeace)

National political targets

Regional anonymous opposition

Local personal resistance

### **2. Factual specific restrictions**

Fisheries

Habitat protection

Recreation

## **Economical effective tools**

- Investment support (% of investment related to environmental quality)
- Feed in tarif (best experienced und most effective simple system)
- Green certificates (difficult on national level)
- Tax relief (reduction or abolition at least for a certain period)
- Grid utilisation fee (reduction or abolition)
- Direct supply (additional tool)

## Project development hierarchy

- National development plan public
- Regional master-plan public
- River exploitation concept public
- Site specific optimisation – general project private
- Detailed project - basis for approval procedure private
- Installation project – basis for implementation private

## **Engineering is not everything**

What is needed urgently:

**Involvement**

**Excellence**

**Integration**

**Information**

## **Involvement**

Of people geographically directly concerned

Of governmental representatives

Of NGOs

Of communities

Of media

## **Excellence**

- In technical terms
- With regard to environmental demands
- Concerning negotiation techniques
- In social competence

## **Integration**

- Of public interests
- Of cross-border targets
- Of still existing projects
- Into national or international development programs

## **Public relation**

- National & International media
- Communities
- Educational bodies
- Competing groups

## **Environmental aspects**

- Reserved flow
- Fish bypass systems
- Design
- Trash rack material management
- Noise and vibrations
- Fish friendly turbines

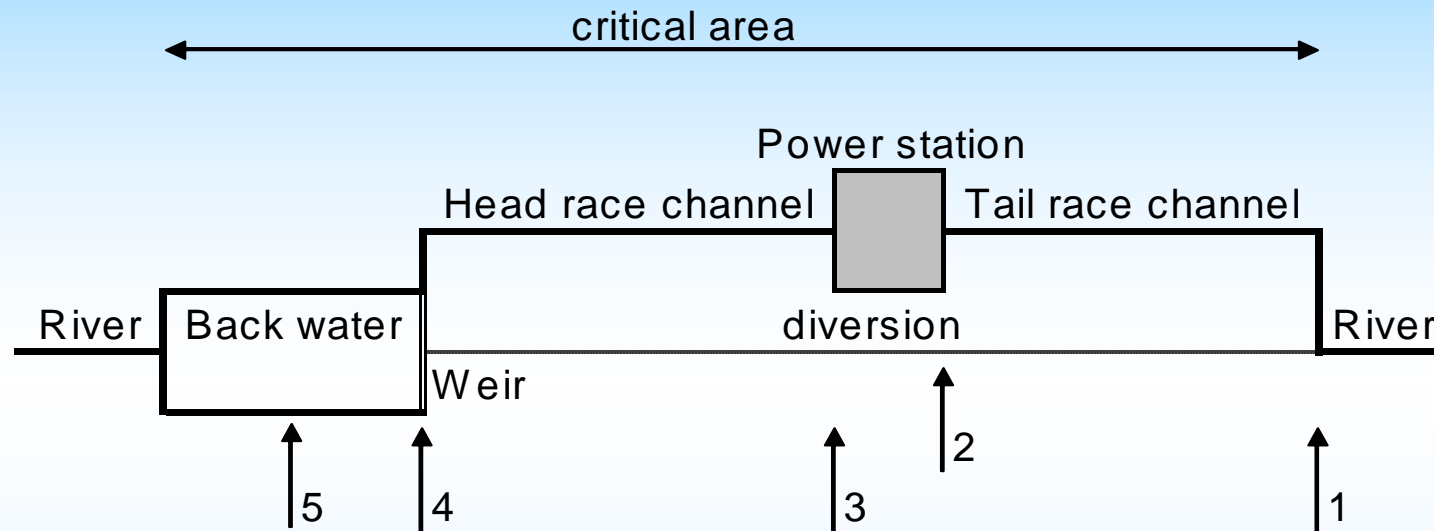
## **Reserved flow**

- Methods based on hydrologic or statistic values
- Methods based on physiographic principles
- Formulas based on velocity and depth of water
- Methods based on multi-objective planning taking into consideration ecological parameters

## Fish bypass systems

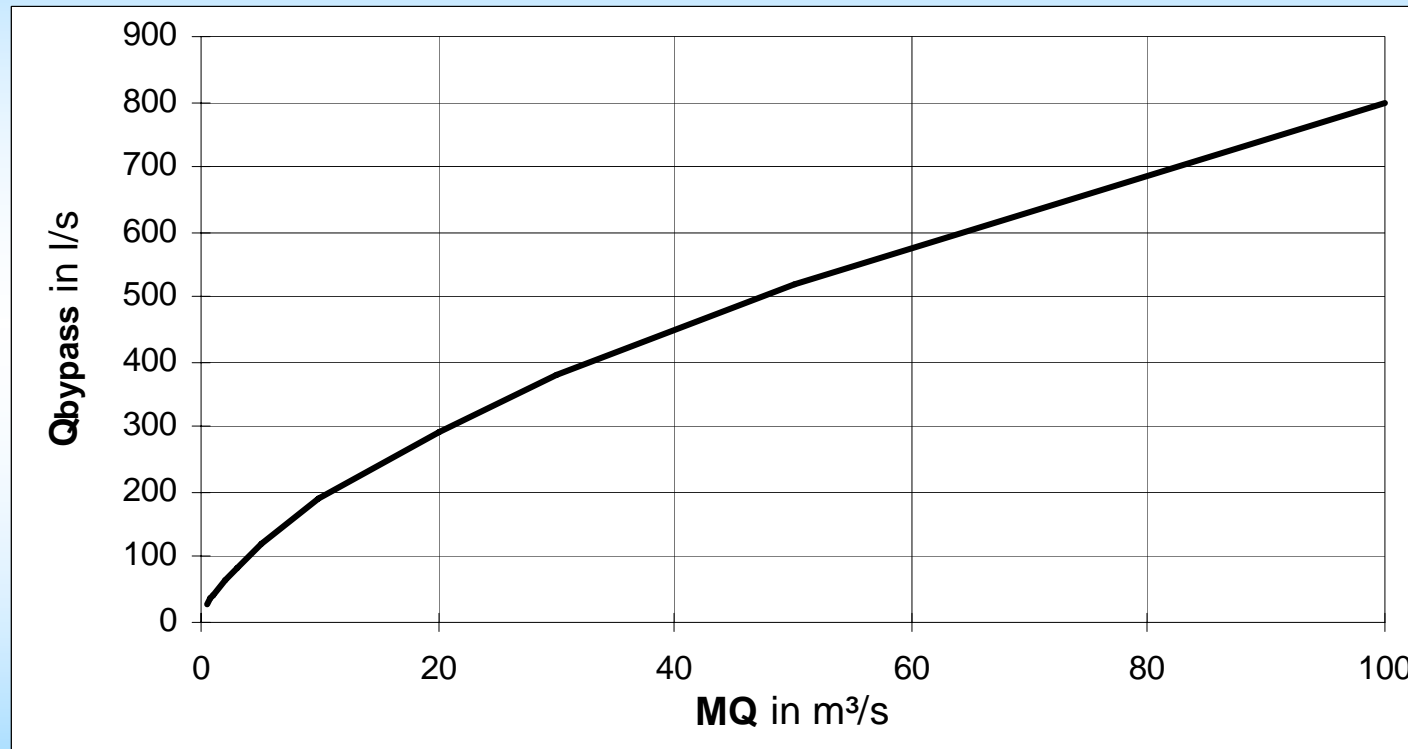
- **Fish ladder** (dividing up total head into low passable steps between small basins)
- **Fish bypass systems** (imitating the morphology as well as the hydraulics of small creeks)
- **Fish lift**

## Fish bypass systems



- 1 mouth of the tailrace channel (attraction flow)
- 2 power house (head, space available)
- 3 diversion section (residual flow - hydraulic problems in velocity and depth)
- 4 weir (head)
- 5 back water area (attraction flow, velocity)

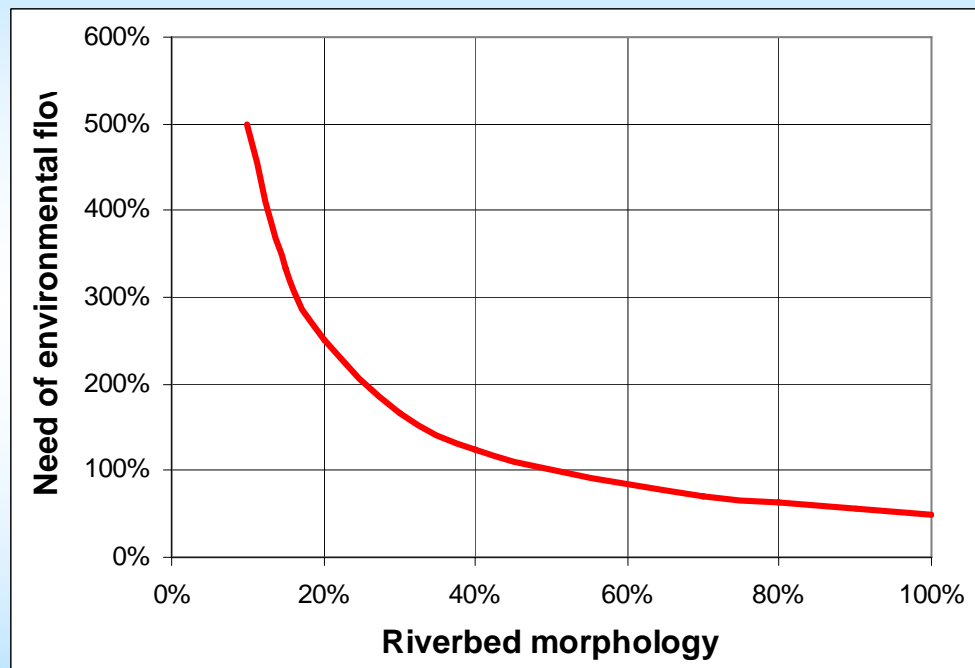
## Fish bypass systems



## Design

- Open waterways
  - *Backwater areas*
  - *Headrace channel*
  - *Tailrace channel*
  - *Diversion reach*
- Penstocks
  - *Open*
  - *Interred*
- Power houses

## Diversion reach



Evaluation by

- The amount of residual flow
- The structure of the riverbed
- The duration of diversion

## **Conclusions**

- Recent conditions and new challenges have to be met with adequate means
- New requirements are multidimensional
- SHP - Exploitation is a site-specific, individual task
- SHP exploitation is a highly professional job
- SHP exploitation requires a synchronous and interdisciplinary balanced design process

# Training workshop – SYNERGY Programme “Train the trainers”

18.-23. April 2005, International Center of Hydropower, Hangzhou



Thank you !