

SHP – facts and how to cope with **小水电—现状和应对策略**

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Contents 内容

- Statistical data & their uncertainty 统计数据及其不确定性
- Incentives and barriers 激励机制和障碍
- Engineering process 工程过程
- Additional requirements and skills 其他要求和技能
- Environmental aspects 环保问题

Statistical problems 统计数据的问题

- European SHP defined by $N < 10$ MW 欧洲小水电定义 <10 MW
- Different source quality of data (official, private) 来自不同来源和质量的数据（官方和私人）
- Different time of updating 不同的更新时间
- Obligatory registration only with „feed in“ situation 只有上网的电站才有注册的义务
- In small SHP (<100 kW) data often not available 对于小于 100 kW 的项目数据经常无法得到
- Public availability of data (national data protection) 公众能否得到数据（国家数据保护）
- Completeness 数据完整性

Training workshop – SYNERGY Programme “Train the trainers”

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

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Statistical data & their uncertainty (2)

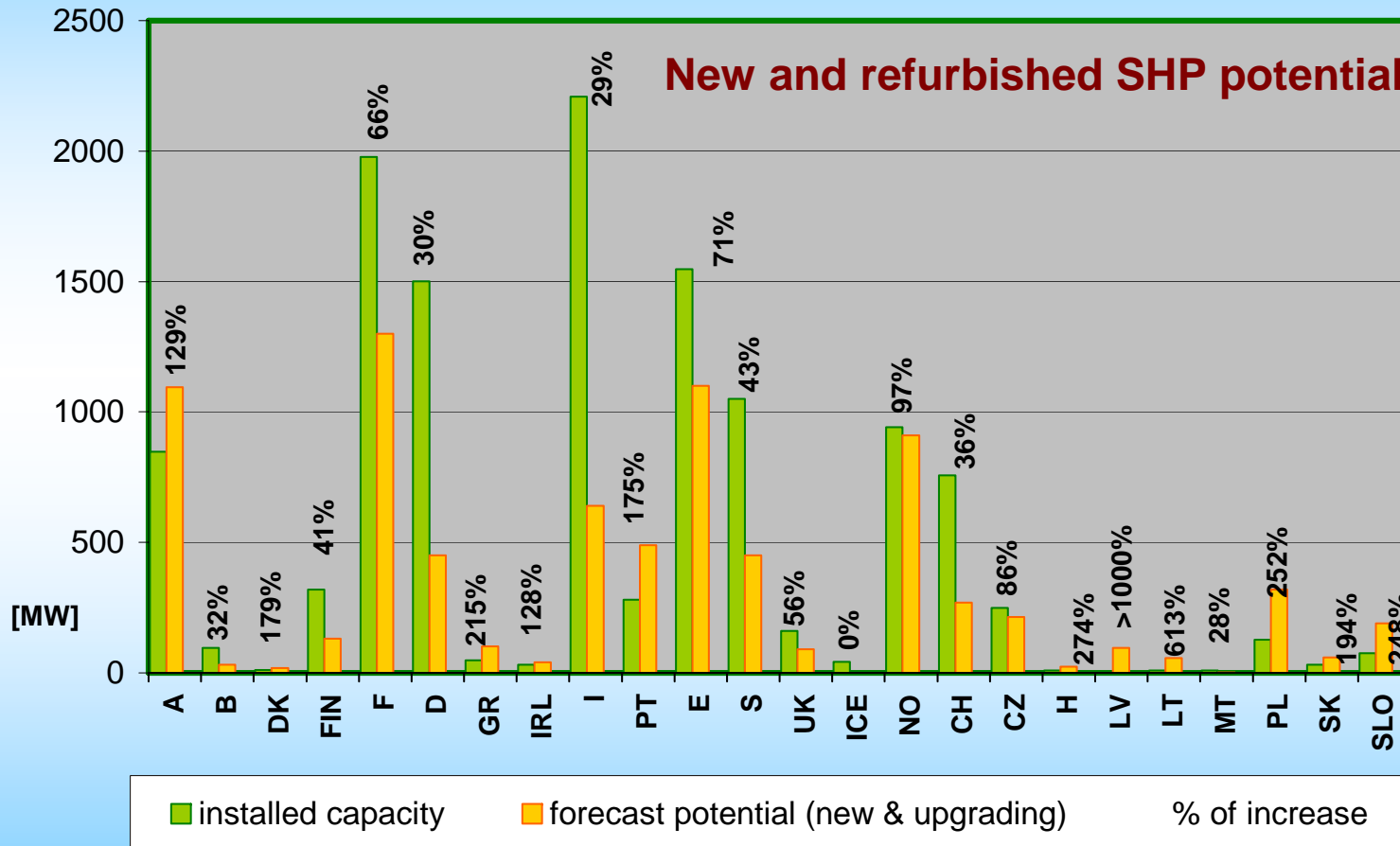
SHP – Production in Europe 15 欧洲15国小水电生产

Land	MW	GWh/a	EW in Mio.	W/E	Fläche	kW/km ²
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
Gesamt	9.833	38.433	378	26,01	3.236.600	3,04

SHP – Production worldwide 世界范围内小水电

	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 欧洲小水电潜能



What is potential? Theory versus reality

什么是潜能？理论与实践

100% natural potential (Q x H) 100% 自然潜能

65% technical feasible 65% 技术可行

45% technical & economical feasible 45% 经济和技术可行

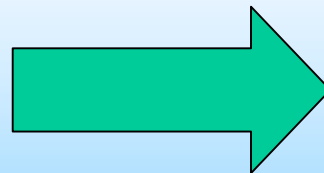
30% technical & economical & environmental feasible 30%

技术、经济和环境可行

All decisive parameters have a time variability !!

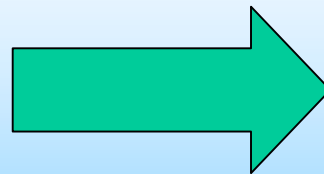
Political will 政治意愿

- International commitment (in European Union: RE directive)
国际承诺（欧盟可再生能源法案）
- International discipline (Kyoto protocol) 国际约束（京都议定书）
- National economical targets (energy independency) 国家经济目标（能源独立）
- National public pressure (newspapers, elections, etc) 公共压力（新闻报道，选举等等）
- Regional development plans 地区发展计划



Legislational Framework 法律框架

- Granting procedure (concentration vs diversity) 审批程序（集中还是分散）
- Water rights (unlimited vs bidding system) 水权（无限使用还是招标体系）
- Environmental law (restrictive vs consensous) 环境法（限制的还是支持的）
- Energy law (supportive vs prohibitive) 能源法（支持还是限制）
- Energy pricing (high vs low) 能源价格（高还是低）



Environmental restrictions 环境限制

1. General non-specific restrictions 一般限制

International groups (WWF, greenpeace) 国际组织 (世界自然基金会, 绿色和平组织)

National political targets 国家政治目标

Regional anonymous opposition 地区自治反对

Local personal resistance 当地个人阻力

2. Factual specific restrictions 具体限制

Fisheries 渔业

Habitat protection 栖息地保护

Recreation 娱乐

Economical effective tools 经济可行工具

- Investment support (% of investment related to environmental quality) 投资支持（和环境质量相关的投资百分比）
- Feed in tarif (best experienced und most effective simple system) 上网电价（最具经验和最有效的简单系统）
- Green certificates (difficult on national level) 绿色证书（在国家层次上较难实施）
- Tax relief (reduction or abolition at least for a certain period) 税收优惠（至少在一定时期内减免）
- Grid utilisation fee (reduction or abolition) 电网使用费减免
- Direct supply (additional tool) 直接支持（额外的工具）

Project development hierarchy 项目发展层次

- National development plan 国家发展计划 public
- Regional master-plan 地区开发计划 public
- River exploitation concept 河流开发计划 public
- Site specific optimisation – general project private
针对个别电站的优化
- Detailed project - basis for approval procedure private
具体的项目计划—审批的基础
- Installation project – basis for implementation private
项目实施—实施的基础

Engineering is not everything

不仅仅是工程问题
What is needed urgently:

其他急需关注的问题

Involvement 参与

Excellence 优化

Integration 整合

Information 信息

Involvement参与

Of people geographically directly concerned 项目当地居民的参与

Of governmental representatives 政府代表的参与

Of NGOs 民间组织的参与

Of communities 社区参与

Of media 媒体参与

Excellence 优化

- In technical terms 技术性能
- With regard to environmental demands 环境要求
- Concerning negotiation techniques 考虑谈判技术
- In social competence 社会竞争力

Integration 整合

- Of public interests 公众利益
- Of cross-border targets 跨国目标
- Of still existing projects 现存的项目
- Into national or international development programs
加入国家或国际发展计划

Public relation 公共关系

- National & International media 国家和国际媒体
- Communities 与社区的关系
- Educational bodies 与教育机构的关系
- Competing groups 与竞争对手的关系

Environmental aspects 环境因素

- Reserved flow 保留流量
- Fish bypass systems 过鱼系统
- Design 设计
- Trash rack material management 拦污栅管理
- Noise and vibrations 噪音和震动
- Fish friendly turbines 保护鱼类的水轮机

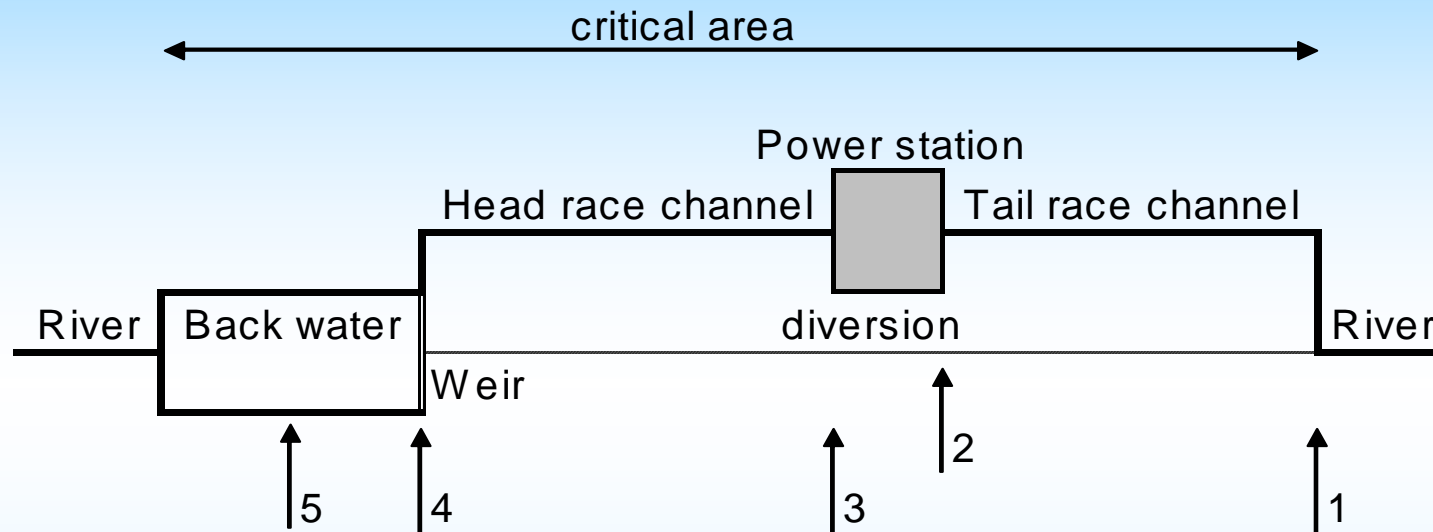
Reserved flow 保留流量

- Methods based on hydrologic or statistic values 依据水文或统计数据的方法
- Methods based on physiographic principles 根据地形原理的方法
- Formulas based on velocity and depth of water 依据流速和水深公式
- Methods based on multi-objective planning taking into consideration ecological parameters 考虑生态因数的多重目标计划

Fish bypass systems 过鱼系统

- **Fish ladder** (dividing up total head into low passable steps between small basins) 鱼梯（将总水头划分为若干个鱼类可通过的阶梯状小流域）
- **Fish bypass systems** (imitating the morphology as well as the hydraulics of small creeks) 过鱼系统（人工模拟小溪的形态和水利过程）
- **Fish lift** 升鱼装置

Fish bypass systems 过鱼系统

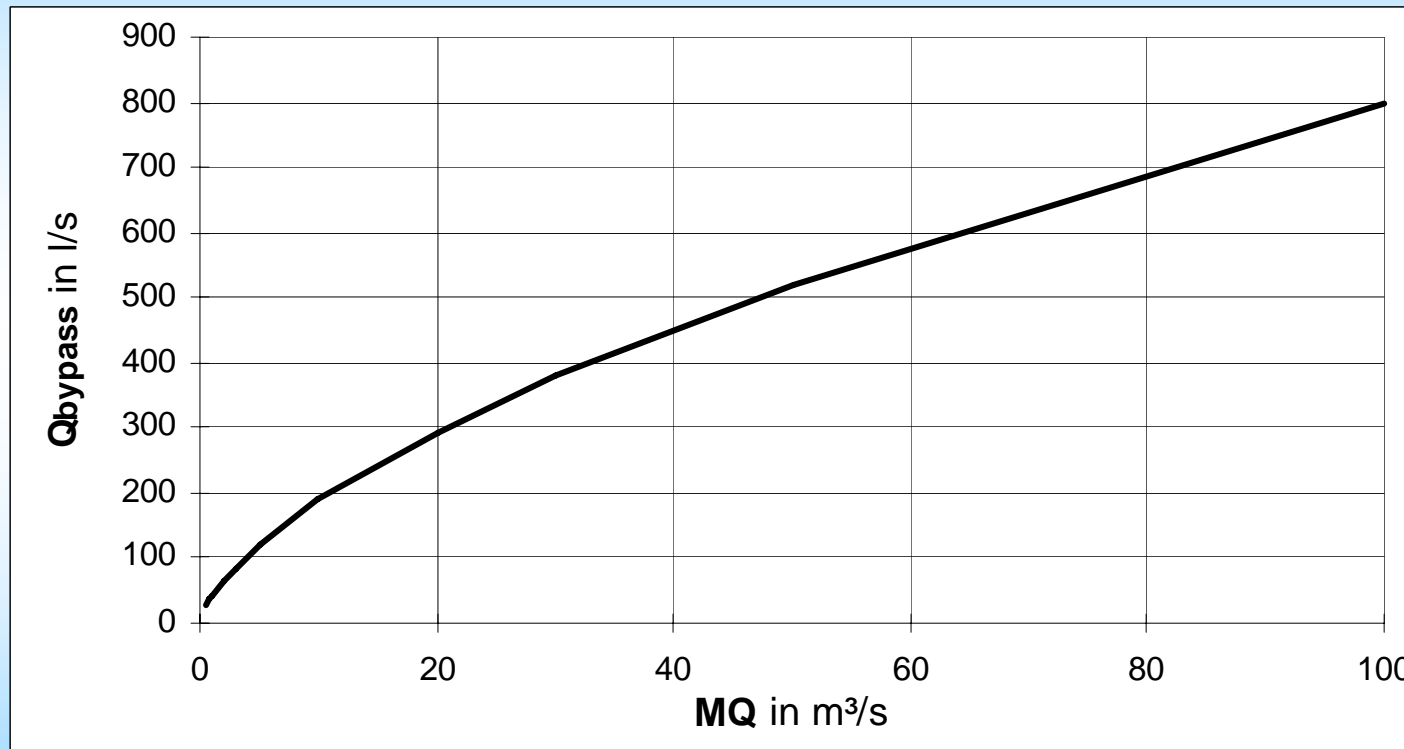


- 1 mouth of the tailrace channel (attraction flow) 1 尾水渠开口
- 2 power house (head, space available) 2 厂房
- 3 diversion section (residual flow - hydraulic problems in velocity and depth)
3 引水装置 3 (剩余流量—关于流速和水深的问题)
- 4 weir (head) 4 堰顶
- 5 back water area (attraction flow, velocity) 5 滞水区

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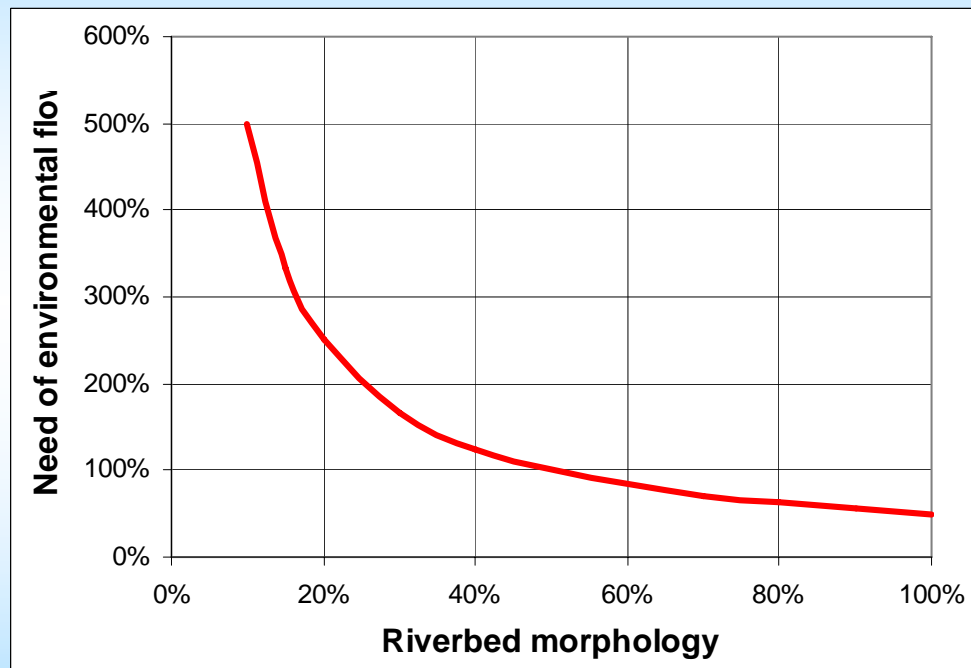
Fish bypass systems 过鱼系统



Design设计

- Open waterways 开放式水路
 - *Backwater areas* 滞水区
 - *Headrace channel* 进水渠
 - *Tailrace channel* 尾水渠
 - *Diversion reach* 引水道
- Penstocks 压力钢管
 - *Open* 敞开式
 - *Interred* 埋入式
- Power houses 厂房

Diversion reach 引水道



Evaluation by

- The amount of residual flow
剩余流量
- The structure of the riverbed
河床结构
- The duration of diversion
引水时间

Conclusions 结论

- Recent conditions and new challenges have to be met with adequate means 现状和新挑战需要足够的方法来应对
- New requirements are multidimensional 新的需要是多层次的
- SHP - Exploitation is a site-specific, individual task 小水电开发是因站而异的个别任务
- SHP exploitation is a highly professional job 小水电开发是一项专业化的工作
- SHP exploitation requires a synchronous and interdisciplinary balanced design process 小水电开发需要跨专业的同步的设计过程

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Thank you !



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