CHECKIST ON SMALL HYDROPOWER

PRE FEASIBILITY STUDY ON SMALL HYDRO

Coordinated by MHyLab, SCPTH and ESHA

With input from the Thematic Network on Small Hydropower (TNSHP)
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STUDIO FROSIO

Introduction

This small Hydropower checklist aims at giving potential and even inexperienced developers/investors of small hydropower plants first comprehensive information and advice on all necessary procedures required to start and develop small-hydropower projects. Its objective is to guide the investor/developer so as to determine the viability of a project, using a simple step-by-step process. This checklist can be used in combination with the *Guidebook on How to Develop a Small Hydropower Plant*, a more complete document also achieved by the Thematic Network on Small Hydropower, where all the necessary steps mentioned in the checklist are deeply explained.

This checklist has been carried out under the coordination of MHyLab and ESHA with the input of all the partners of the Thematic Network on Small Hydropower (ADEME, ISET, IT Power, Studio Frosio, EPFL-LCH, SERO, SCPTH, ÖVFK) in the scope of a project supported by the European Commission and the Swiss Government under the framework of the FP5 programme.

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Summary

The purpose of this document is to provide guidance to new and inexperienced investors, in the processes involved to develop **small hydropower projects**. Its' aim is to guide the investor/developer through the process of determining the viability of a project, using a simple step by step process. An investor wishing to develop a new, or renovate an existing, hydropower installation will need to collate a lot of technical, environmental and financial information, discuss the project with various regulatory authorities as well as seeking the views of those that may be affected by the development.

All of this information will be required before deciding whether to proceed with a planning application and obtain any necessary licenses or consents.

Obtaining all the information required for the planning application can carry significant costs, as the details needed for, say, an Environmental Assessment may be considerable and have to be carried out by specialist individuals or organizations. For many small hydropower schemes the cost of this work can be a significant proportion of the overall scheme costs. These costs could be incurred without any guarantee the scheme would obtain the permissions needed construct. This financial hurdle is one that could deter a potential developer from investing in small hydropower, or a developer who has incurred high costs from previous project proposals, from future investments.

This guide is aimed at encouraging investment in Renewable Energy Technologies, such as small hydropower, by simplifying the process and the lowering the costs of project pre-feasibility. It is hoped that the guide will help the investor to decide whether to proceed with the project and provide the regulators and planners enough information to give an indication as to any potential barriers, or blockers to successful approval, at an early stage in the project plan.

The guide will take the potential investor/developer through the following steps for pre-feasibility :-

- **ENERGY PRODUCTION** – This involves the estimation of the water available from either, rainfall data, river catchment area, run off and evaporation rates, or actual river flow data from at, or near the proposed site of water abstraction. The head (that is the vertical height or fall of water to the turbine and for water wheels the diameter of the wheel) and flow rate can be used to calculate the power potential and also the annual power production.

- **INTEGRATION INTO THE ENVIRONMENT** – This would involve discussing the project proposal with the environmental protection agencies, to ascertain the amount of river flow available for abstraction, residual flows that must be left to protect the aquatic biodiversity and any other environmental mitigation measures required. The local planning authority will also be able to advise on their policy concerning the site and buildings and environmental aspects of construction. It may be necessary to prepare some outline plans for this, so discussions with turbine manufacturers would be appropriate at this stage, most would be able to provide an outline sketch of a suitable layout for this at no or minimal charge. It would also be advisable to discuss your project with any neighbours and other local interest groups such as fishing, leisure groups and navigation authorities, at this stage, to take on board any concerns they may have.

Operational, or running costs, are the day to day and annual expenses that will be occurred whilst the hydropower plant is working, such as :-

1. Local and national taxation on income
2. Employee costs
3. Plant repair and maintenance cost
4. Annual license costs
5. Charges for the use of the electrical network (grid), if needed

This figure is typically a percentage of the investment cost

- **ECONOMIC APPRAISAL** – With the information collated on the estimated annual energy production an estimation of the annual income can be made. For this the investor will need to investigate the electrical energy sales market. Discussions with the different supply companies will reveal the various types of sales contracts on offer. The income can be made up from energy sales as well as trading in green energy.

  With the information gathered from the checklist a full investment appraisal of the cash flow can be made to determine the rate of return and payback. It is also worthwhile checking to see if there are any capital grants available for renewable projects in your location.

Throughout the document there will references to where further and more detailed information can be found. The terminology used, is either self explanatory or drawn from the glossary of the Layman's guide on how to develop a SHP plant produced by ESHA. Membership of your national hydropower or renewable energy trade association would be advantageous. The European Small Hydropower Association (ESHA) is also there to assist. These bodies are constantly active in promoting and advising on hydropower. A glossary of all the trade associations and their contacts is provided with the checklist.

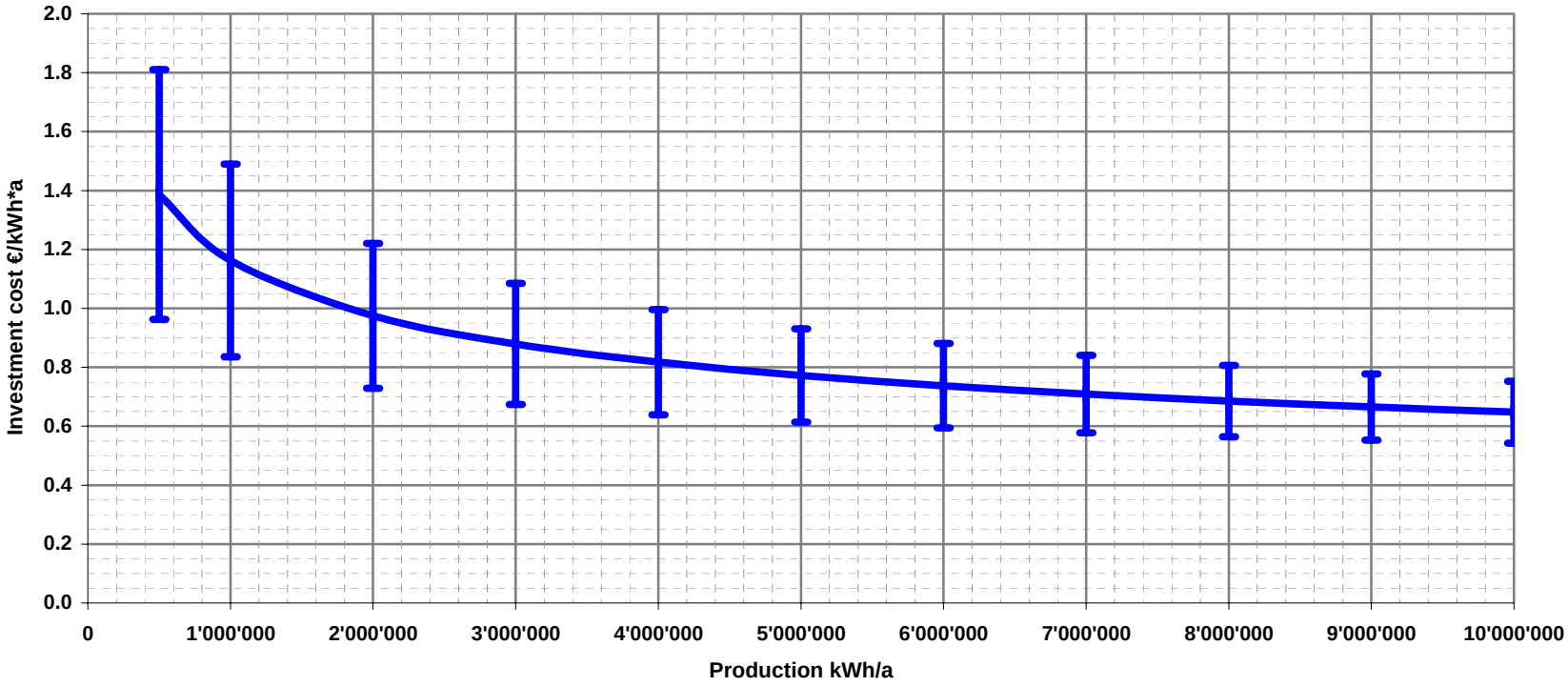
As mentioned before this guide is to allow the investor/developer to make an informed and early decision on whether, or not, to invest in a small hydropower project without incurring too high costs. It is suitable for a pre-feasibility study, which can be followed by a more in depth feasibility study should the economics look favourable.

The document is intended to be a live document and will be continuously reviewed and updated by ESHA and its member national trade associations.

PRE FEASIBILITY STUDY ON SMALL HYDRO		
THEMATIC NETWORK ON SMALL HYDRO POWER		
Operations	**The different stages**	**Links to the Guide ***
Step 1. ENERGY PRODUCTION		
Water resources availability		§ 3
	Estimate the catchment area and its main characteristics	§ 3.3
	Estimate the mean rain falls	§ 3.4.3
	Estimate the mean flow (average flow/year=Q°)	§ 3.2 / 3.3 / § 3.4
Head availability		§ 3.4.5
	Measure the Gross Head	§ 3.4.5.1
	Estimate the Head losses	§ 3.4.5.2 / § 3.6.1/ § 2.2 /§ 5.5.3 / § 6.2.5
	Calculate the net head (Hn)	§ 3.4.5.2
Expected energy production		§ 3.6 / § 6.2.1 / § 6.2.5
	Define the electrical power output	
	Calculate P (kW) = Q x Hn x 8	
	Estimate the approximated annual energy production	
	from E (kWh/year) = P (kW) x 4000 (h/year)	
Step 2. ADMINISTRATIVE AND ENVIRONMENTAL ASPECTS		administration : § 9 / environment : § 7
Identify the relevant official authorities		
Identify the non-governmental organisations	WWF, Pro-Natura, Fishermen, …	
Discuss the main issues regarding		§ 9.2.1
	Water availability	
	Administrative procedures	§ 9
	Environmental issues:	§ 7
	water quality	
	Reserved flow	§ 3.5 / § 7.4.3.2 / § 9.2.2.2
	Flood prevention	§ 3.8 / § 5.3
	Fish passages	§ 7.4.3.2.6 / § 7.4.3.2.7
	Leisure activities	
	Groundwaterflow patterns	§ 4
	Re-creation of zones with alluvial vegetation	§ 7.4.3
	Visual integration of hydraulic structures	§ 7.4.2
	Technical issues:	§ 5
	Feasibility of necessary hydraulic structures (dike, dam, intake, etc.)	§ 5
	Sediment transport / river morphology on long term	§ 5.6
	Geology of area of interest / Geotechnical feasibility structures	§ 4
	Conditions to the access and physical integration to the grid	§ 9 / § 9.2.3 / § A.3
	Planning permissions	
Engage a consultation with the various parties at the earliest stage		
Step 3. ELECTRICITY SALES		§ 8
Determine the sources of electricity sales and market value		
	Contractual conditions	
	Price of the contract	
	Duration of the contract	
Calculate the average market value		§ 8.5
Calculate the gross income (= market value x E)		
Step 4. INVESTMENT COSTS		§ 8
Estimate the cost		
Calculate the formula versus energy		
Calculate the formula versus power		
		§ 8
Step 5. OPERATION AND MAINTENANCE		
Determine the cost associated with local and national taxes policies		
Determine abstraction cost for use of water		
Determine maintenance costs	Percentage of annual income	
Determine the running and operation costs		
Calculate the net income (around 75 to 85 % of the gross income)		
Step 6. ESTIMATION OF ECONOMICS		§ 8
Determine the cashflow		
Determine the gross payback time	= investment cost / gross income	
Determine the interest rate		

Links to the Guide (*): it deals with the "Guide on how to develop a small hydro site, which is available on the ESHA web site, in English, French, German and Swedish

Evaluation of the investment cost from the annual electrical production



For example, considering 5'000 hours of full load per year, the investment cost for a 100 kW SHP ranges from 0.95 to 1.80 euros per kWh/year or from 475'000 and 900'000 euros, whereas for a 2 MW SHP it ranges between 0.55 and 0.75 euros per kWh/year, or between 5.5 and 7.5 millions of euros.

Power plants characteristics			Investment costs		Investment	
electrical power	full load hour factor	electrical production	min	max	min	max
kW	hour/year	kWh/year	euros/(kWh/year)	euros/(kWh/year)	euros	euros
100	5000	500'000	0.95	1.8	475'000	900'000
2000	5000	10'000'000	0.55	0.75	5'500'000	7'500'000

Source:

Cost Curve, Thematic network on small hydropower, ESHA (www.esha.be), 2005

List of the documents created by the Thematic Network

All these documents are avaiblable in the librairies of the ESHA web site (www.esha.be) or of the TN web site.

Checklist steps	Original title	Available languages	Where to find it
1, 2, 3, 4, 5, 6	Guide on How to develop a small hydro site	English, French, German, Swedish	CDROM to be requested from ESHA + ESHA website
1, 2, 3, 4, 5, 6	Frequently asked questions (FAQs)	English, French, German	ESHA website
2	Brochure on the environmental aspects of the small hydroelectric plants	English	ESHA website
2	Reserved Flow - Effects of additional parameters on depleted Stretch	English	ESHA website
2	Reserved Flow - Short critical review of the methods of calculation	English	ESHA website
	R&D list	English	ESHA website
	Proposals for a European Strategic of Research, Development and Demonstration for renewable energy from small hydropower	English	ESHA website
	Report On Small Hydropower Statistics: General Overview Of The Last Decade (1990-2001)	English	ESHA website
	Situation of small hydropower in the new members states and in the candidate countries	English	ESHA website

Original language	books reference	Step	Title translated in English	Original Title	Author	year	Edition	Country
ENGLISH	r001	1,2,3,4,5	The guide to hydropower, mechanical design	The guide to hydropower, mechanical design	American society of mechanical engineers,Hydro Power,Technical		HCI Publications	Kansas City, U.S.A.
	r002	1,2,3,4,5	Hydro plant, electrical systems	Hydro plant, electrical systems	David M. Clemen		HCI Publications	Kansas City, U.S.A.
	r003	1,2,3,4,5	Micro Hydro Design Manual	Micro Hydro Design Manual			Adam Harvey Intermediate Technology Publications ISBN No 1-85339-103-4	
	r004	1,2,3,4	Renewable Energy, Power for a Sustainable Future	Renewable Energy, Power for a Sustainable Future	Godfrey Boyle The Open University,		Oxford University Press ISBN No 0-19-856451-1	
	r005	1,2,3,4,5	Hydro Power,The design,use and function of hydro mechanical,hydraulic,and electrical	Hydro Power,The design,use and function of hydro mechanical,hydraulic,and electrical equipment	Joachim Raabe		VDI Verlag GmbH	Duesseldorf, Germany
	r006	1,2, 3	Micro-Hydropower Sourcebook, A Practical Guide to Design and Implementation in Developing Countries	Micro-Hydropower Sourcebook, A Practical Guide to Design and Implementation in Developing Countries	Allen R. Inversin	Third printing, August 1995	NRECA International Foundation	4301 Wilson Boulevard, Arlington VA 22203-1860, USA
	r007	1,2, 3	Report on Standardization of civil works for Small Hydropower Plants	Report on Standardization of civil works for Small Hydropower Plants	UNIDO, United Nations Industrial Development Organization	December, 1988	EWI Engineers+Consultants	Zurich, Switzerland
	r008	1, 4, 5, 6	Engineering and design hydropower	Engineering and design hydropower	US Army Corps of Engineers	1985	USACE	USA
GERMAN	r009	1,2,3,4,5	Hydropower equipment, 2nd edition	Wasserkraftanlagen,2.Auflage	J.Giesecke,E.Mosonyi		Springer Verlag	Berlin Heidelberg, Germany
	r010	1,2,3,4,5	Hydraulic machines and equipment	Hydraulische Maschinen und Anlagen	Joachim Raabe		VDI Verlag GmbH	Duesseldorf, Germany
	r011	1, 2,5	Flaoting wastes and small hydropower plants, optimisation of the water intakes, Diane 10, small hydropower plants, 2000 Energy Programme	Geschwemmsel bei Kleinwasserkraftwerken, Optimierung der Wasserfassung, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	Ueli Schälchli, Andreas Baumgartner, Peter Bauman	1997	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r012	1, 2, 5	Small hydropower plants and water ecology, analyse of the situation, Diane 10, small hydropower plants, 2000 Energy Programme	Kleinwasserkraftwerke und Gewässerökologie, Situationsanalyse, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	Claudia Zaugg, Hanspeter Leutwiler	1998	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r013	1,2,3,4,5,6	Electricity from wastewater systems, concept, realisation, potential, Diane 10, small hydropower plants, 2000 Energy Programme	Elektrizität aus Abwasser-Systemen, Konzept, Realisation, Potential, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	R. Chenal, C.-A. Vuillerat, J. Roduit	1995	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r014	1,2,3,4,5,6	Hydropower plants on drinking water, documentation on the technical equipment, Diane 10, small hydropower plants, 2000 Energy Programme	Trinkwasserskraftwerke, Technische Anlagendokumentation, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	Peter K. Burger, Heinz Gross	1997	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r015	1,2,3,4,5,6	Energy assessment of small hydropower plants, Pay back time and energy factor, Diane 10, small hydropower plants, 2000 Energy Programme	Energiebilanzen von Kleinwasserkraftwerken, Energierückzahldauer und Energieerntefaktor, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	W. Baumgartner, G. Doka	1996	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r016	1,2,3,4,5,6	Pico-power plants, the very small power plants to be installed by oneself, Diane 10, small hydropower plants, 2000 Energie Programme	Pico-Krafwerke, Kleinste Wasserkraftwerke mit Eigenleistungen bauen, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	Gian-Andri Tannò	1996	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r017	1,2,3,4,5,6	To renovate instead of abandoning, modernisation and recommissioning of the small hydropower plants, evaluation criteria, Diane 10, small hydropower plants, 2000 Energy Programme	Nutzen statt Aufgeben, Modernisieren und Reaktivieren von klein-Wasserkraftwerken Beurteilungskriterien, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	Walter Nüssli	1994	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland

Original language	books reference	Step	Title translated in English	Original Title	Author	year	Edition	Country
GERMAN	r018	1,2,3,4,5,6	General overview of the small hydropower plants, economical and ecological aspects, Diane 10, small hydropower plants, 2000 Energy Programme	Gesamtschau Kleinwasserkraftwerke, Ökonomische und ökologische Aspekte, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	Louis von Moos, Hanspeter Leutwiler	1997	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r019	2, 4, 5, 6	Fish and small hydropower plants, favourable crossing solutions for fish and aquatic microfauna, Diane 10, small hydropower plants, 2000 Energy Programme	Fische und Kleinwasserkraftwerke, Kostengünstige Aufstieghilfen für Fische und Kleinlebewesen, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	Claudia Zaugg, J.C. Pedroli	1997	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r020	1,2,3,4,5,6	Handbook 1997, small hydropower plants, information on the planing, construction and operation, Diane 10, small hydropower plants, 2000 Energy Programme	Handbuch 1997, Kleinwasserkraftwerke, Informationen für Planung, Bau und Betrieb, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	Louis von Moos, Hanspeter Leutwiler	1997	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r021	1, 2, 5	Small hydropower plants in a hydro network, to maintain the biological continuum of the waters, Diane 10, small hydropower plants, 2000 Energy Programme	Vernetzung bei Kleinwasserkraftwerken, Biologisches Kontinuum der Gewässer erhalten, Untersuchung über das Gewässerkontinuum für Fische und Kleinlebewesen, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	Claudia Zaugg	1997	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r022	1,2,3,4,5,6	Drinking water as an electricity generator, inventory and study of the potential of the electric power plants on the dirnking water networks in Switzerland, Diane 10, small hydropower plants, 2000 Energy Programme	Elektrizität aus Trinkwasser-Systemen, Inventar und Potentialerhebung trinkwasser-Kraftwerke in der Schweiz, DIANE 10, Klein-Wasserkraftwerke, das Aktionsprogramm Energie 2000	Markus Hintermann	1994	Bundesamt für Energiewirtschaft (BERN), Schweiz	Switzerland
	r023	1	Turbines	Strömungsmaschinen	Willi Bohl	1998	Vogel Fachbuch, Kamprath- Reihe	Germany
FRENCH	r024	1,2,3,4,5	Applied hydropower	Hydraulique appliquée	Ecole nationale de métiers de la Périollière		Electricité de France	France
	r025	1,2,3,4,5	Hydropower	L'énergie hydraulique	R.Ginocchio		Editions Eyrolles	Paris, France
	r026	1,2,3,4,5	Mechanical systems, Theory and Dimensionning	Systèmes mécaniques,Théorie et Dimensionnement	M.Aublin,R.Boncopmain, M.Boulaton		Dunod	Paris, France
	r027	1,2,3,4,5	Technology of the hydraulic material	Technologie du matériel hydraulique	J.Combe		Ecole nationale des métiers de la Pérollière	France
	r028	1,2,3,4,5	Hydropower plants, diversion plants, part 1, water collecting, pipe with free discharge	Usines hydrauliques,Usines de dérivation,Tome1,captage des eaux,canalisation à écoulement libre	Henri Varlet		Editions Eyrolles	Paris, France
	r029	1,2,3,4,5	Diversion plants, part 2	Usines de dérivation,Tome 2	Henri Varlet		Editions Eyrolles	Paris, France
	r030	1,2,3,4,5	Hydropower plants, constructional works, operation and cost price of the hydropower plants	Usines hydrauliques,Aménagement,utilisation et prix de revient des usines hydrauliques	Henri Varlet		Editions Eyrolles	Paris, France
	r031	1,2,3,4,5	Hydropower plants, storage plants, run-of-river plants	Usines hydrauliques,usines de retenue, usines de plaine	Henri Varlet		Editions Eyrolles	Paris, France
	r032	1,2,3,4,5	hydropower turbines and their regulation, Theory, construction, Operation	Turbines Hydrauliques et leur régulation,Théorie,Construction, Utilisation	Lucien Vivier		Editions Albin Michel	Paris, France
	r033	1,2,3,4,5	Illustrated course sheets, A, 2nd edition	Feuilles de Cours illustrées,A,2ème édition	Prof.Th.Bovet		Ecole Polytechnique Féderale de Lausanne, IMH	Switzerland
	r034	1,2,3,4,5	Illustrated course sheets, B, 2nd edition	Feuilles de Cours illustrées,B,2ème édition	Prof.Th.Bovet		Ecole Polytechnique Féderale de Lausanne, IMH	Switzerland
	r035	1,2,3,4,5	Exploitation and maintainance of the hydro-electric groups	Exploitation et maintenance des groupes hydroélectriques	Bernard Comte		Publication 54 de l'Association pour l'aménagement des eaux Baden	Switzerland

Original language	books reference	Step	Title translated in English	Original Title	Author	year	Edition	Country
FRENCH	r036	1, 2, 6	Small hydropower plants and water ecology, analyse of the situation, Diane 10, small hydropower plants, 2000 Energy Programme	Petites centrales hydrauliques et écologie des eaux, Analyse de situation, Diane 10, Petites centrales hydrauliques, Programme Energie 2000	Claudia Zaugg, Hanspeter Leutwiler	1997	Office fédéral de l'Energie, Berne	Switzerland
	r037	2, 4, 5, 6	Fish and small hydropower plants, favourable crossing solutions for fish and aquatic microfauna, Diane 10, small hydropower plants, 2000 Energy Programme	Poissons et petites centrales hydrauliques, Solutions avantageuses de franchissement pour les poissons et la microfaune aquatique, Diane 10, Petites centrales hydrauliques, Programme Energie 2000	Claudia Zaugg, J.C. Pedroli	1997	Office fédéral de l'Energie, Berne	Switzerland
	r038	1,2,3,4,5,6	Pico-power plants, the very small power plants to be installed by oneself, Diane 10, small hydropower plants, 2000 Energie Programme	Pico-centrales, les toutes petites centrales à installer soi-même, Diane 10, Petites centrales hydrauliques, Programme Energie 2000	Gian-Andri Tannò	1996	Office fédéral de l'Energie, Berne	Switzerland
	r039	1,2,3,4,5,6	To renovate instead of abandoning, modernisation and recommissioning of the small hydropower plants, evaluation criteria, Diane 10, small hydropower plants, 2000 Energy Programme	Rénover au lieu d'abandonner, Modernisation et remise en service des petites centrales hydrauliques, Critères d'évaluation, Diane 10, Petites centrales hydrauliques, Programme Energie 2000	Walter Nüssli	1994	Office fédéral de l'Energie, Berne	Switzerland
	r040	1,2,3,4,5,6	General overview of the small hydropower plants, economical and ecological aspects, Diane 10, small hydropower plants, 2000 Energie Programme	Aperçu général sur les petites centrales hydrauliques, Aspects économiques et écologiques, Diane 10, Petites centrales hydrauliques, Programme Energie 2000	Louis von Moos, Hanspeter Leutwiler	1997	Office fédéral de l'Energie, Berne	Switzerland
	r041	1,2,3,4,5,6	Drinking water as an electricity generator, inventory and study of the potential of the electric power plants on the dirnking water networks in Switzerland, Diane 10, small hydropower plants, 2000 Energy Programme	L'eau potable génératrice d'Electricité, Inventaire et étude du potentiel des usines électriques sur l'alimentation en eau potable en Suisse, Diane 10, Petites centrales hydrauliques, Programme Energie 2000	Markus Hintermann	1994	Office fédéral de l'Energie, Berne	Switzerland
	r042	1,2,3,4,5,6	Small hydro-electric installations in Switzerland	Petits aménagements hydro-électriques en Suisse	Département fédéral des transports, des communications et de l'énergie, Office Fédéral de l'Economie des Eaux	1987	Office Fédéral de l'Economie des Eaux	Switzerland
	r043	1,2,3,4,5,6	Small hydropower plants on drinking water, Diane 10, small hydropower plants, 2000 Energie Programme	Petites centrales hydrauliques sur l'eau potable, Diane 10, Petites centrales hydrauliques, Programme Energie 2000	Peter K. Burger, Heinz Gross	1997	Office fédéral de l'Energie, Berne	Switzerland
	r044	1,2,3,4,5,6	Wastewater as an electricity generator, technical file and potential study, Diane 10, small hydropower plants, 2000 Energie Programme	L'Eau usée génératrice d'Electricité, Dossier technique et étude du potentiel, Diane 10, Petites centrales hydrauliques, Programme Energie 2000	R. Chenal, C.-A. Vuillerat, J. Roduit	1995	Office fédéral de l'Energie, Berne	Switzerland
ITALIAN	r045	1,2,3,4,5,6	Hydroelectric plants	Impianti idroelettrici	G. Evangelisti	1982	Patron	Italy
	r046	1,2,3,4,5,6	Machines vol. 1	Complementi di macchine vol. 1	P. Pellò	1983	CLUP	Italy
	r047							

Ref	Web site	Organisation	Observations
W01	www.esha.be	ESHA	
W02	www.small-hydro.com		
W03	www.hydropower.org	International Hydropower Association	
W04	http://hydropower.inel.gov/	US Department of Energy	
W05	http://www.inshp.org/	International Network on Small Hydropower	
W06	http://www.smallhydro.ch/	Bundesamt für Energie - Sektion Erneuerbare Energien	
W07	http://www.mhylab.com	Laboratory for Small Hydropower	
W08	http://www.vatech-hydro.at	VA TECH	
W09	http://www.ademe.fr/	ADEME	
W10	http://www.itpower.co.uk/	IT Power	
W11	http://www.iset.uni-kassel.de	ISET(Institut für Solare Energieversorgungstechnik)	
W12	http://www.hydropower-dams.com/	International Journal on Hydropower and Dams	
W13	http://www.waterpowermagazine.com/	Waterpower and Dam construction magasine	
W14	www.hidroenergia.se	Hidroenergia 2004	
W15	http://microhydropower.net/index.php		
W16			

Ref	Organisation	Address	Web sites
O 01	ESHA	26 RUE DU TRONE	www.esha.be
		B 1000 BRUXELLES	
		TEL 00 32 25 46 19 45	
		FAX 00 32 25 46 19 47	
O 02	Ademe	27, rue Louis Vicat - 75015 Paris	ww.ademe.fr
		Fax : 01 46 45 52 36	
		Tel : 01 47 65 20 00	
O 03	MHyLab	Small hydraulics Laboratory	http://www.mhylab.ch
		CH-1354 Montcherand	
		Tél : + 41 24 442 87 87	http://www.smallhydro.ch
		Fax : + 41 24 441 36 54	
O 04	IT Power Ltd.	Technology House	http://www.itpower.co.uk
		16-18 Whiteladies Road	
		Bristol, BS8 2LG. UK	
O 05	ISET	Koenigstor 59	http://www.iset.de
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O 06	Laboratoire de constructions hydrauliques ENAC - ICARE - EPFL	CH - 1015 Lausanne	http://lchwww.epfl.ch
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O 07	SCPTH	39/41 RUE LOUIS BLANC	
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O 08	Lithuanian Hydropower Association	Universiteto 10, LZUU, Water & Land	http://www.hydrogis.lt/hydropower
		Management Faculty	
		Kaunas, LT-4324 lithuania	
		Tel: + 370 37 752 337	
		Fax: +370 37 752 392	
O 09	Austrian Hydropower Association, Österreicher Verein zur Förderung von Kleinkraftwerken (ÖVFK)	Museumstrasse 5, A-1070 Wien.	
O 10	APPA- Spanish Association of renewable energy producers	C/ Paris, 205 - 08008 Barcelona Spain	http://www.appa.es/
		Tel. 93 4142277	
O 11	International Hydropower Association		www.hydropower.org
O 12	US Department of Energy		http://hydropower.inel.gov/
O 13	International Network on Small Hydropower		http://www.inshp.org/
O 14	Swiss Energy: small hydropower programme	Bundesamt für Energie - Sektion Erneuerbare Energien	http://www.smallhydro.ch/
		CH-3003 Bern	
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		FAX 031 323 25 00	
O 15	Studio Frosio	Via P.F. Calvi, 9 - I - 25125 - Brescia - luigi.papetti@studiofrosio.it	http://www.studiofrosio.it
O 16	ISET Institut fuer Solare Energieversorgungstechnik	ISET Koenigstor 59 D-34119 KASSEL	www.iset.de