CONTENTS

VOLUME 1: Small and Micro/Mini Hydro
Financing, Licensing, and Legal Issues

FOREWORD .......................................................... iii

SMALL AND MICRO/MINI HYDRO ..................................... 1

4.2 MW Hydro Power Plant for Radio Station HCJB, Papallacta, Ecuador
by S. E. Moore, H. G. McKay III, and R. E. Howell ............... 3

Hydroelectric Development Activities of Rural Electric Systems
by Wilson Pritchett ............................................. 13

Rehabilitation of the Orchard Mesa Turbine-Pump Units
by Clinton W. Mehring ........................................ 23

Redeveloping a Low-Head Open Flume Power House Concept to Reality
at Pottsdam, New York
by Wayne Gannett ............................................. 33

Design and Construction of the Granby Hydro Redevelopment Project
by M. R. Vanderburgh, J. P. Costello, and H. S. Gill ............ 42

Upper Mechanicville Hydroelectric Redevelopment Project
by J. J. Case and J. P. Sinclair ................................ 52

Rehabilitation of Timber Crib Hydro Dam, Caribou, Maine
by J. H. Nadeau, A. S. Lucks, and J. H. Bryant .................. 63

Practical Applications for Pumps as Hydraulic Turbines for Small
Scale Hydropower
by Larry L. Shafer ............................................ 74

Machine Selection and Powerhouse Design for Small Hydropower Schemes
by B. W. Leyland ............................................. 84

The Inverted Flow Concrete-Built Siphon System
by Jean-Pierre Bourgeacq ..................................... 94

Utilization of Hydropower of Small Irrigation Structures
by Reda R. Mankbadi, Sami Mikhail, and Amr Baz .............. 102
Philosophy, Theory, and Practice of Low-Cost Micro-Hydro  
by J. L. Woodward, J. T. Boys, and J. M. Elder ............... 112

Low-Head Turbine Studies for Lock and Dam 14 Power Project  
by John Williams, Donald J. Guild, and James E. Hawks .... 121

Optimization and Selection of Penstock and Power Equipment  
Minihydro Installations  
by Ian J. McAlister .................................... 131

Small Hydro Turbine Selection: Three Case Studies  
by B. H. Adams ........................................ 141

Walterhill Small Hydro Project  
by George Flew .......................................... 151

Wailua River Hydropower Study, Kauai, Hawaii  
by James Pennaz ........................................ 159

Generating Hydropower From Municipal Drinking Water Supply Systems  
by Warren P. Heim ....................................... 168

Design and Evaluation of Microhydroturbines (Under 5 HP)  
by J. A. Marquís ........................................ 177

Small-Scale Hydropower from Irrigation Canals  
by Richard J. Heggen .................................... 187

Assumptions on Feasibility Studies of Small Hydro Projects  
by Ruy Fernando Sant'Ana and Ruh-Ming Li .................. 196

Present Situation of Small Hydropower Development in Japan  
by Yoshiaki Matsumura .................................. 206

Standardized Turbines for Mini Hydro Plants  
by Georg Eissfeldt ....................................... 213

Connecting Small Hydroelectric Generation Onto the Power System  
by Charles L. Ballentine ................................ 223

Status of Small Hydroelectric Development in Ontario, Canada  
by Donald Steven Graham ................................ 230

Costs of Small Hydro Projects  
by John P. Christensen .................................. 239

Small Hydro in Thailand  
by George M. Bunk ....................................... 249

Development of Small-Scale Hydroelectric Power in Puerto Rico  
by Thomas G. Gebhard, Jr., William H. Rankin, and  
Ronald D. Scott ........................................ 257
<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro-Hydro Development at the Crossroads</td>
<td>Douglas M. Parrow</td>
<td>266</td>
</tr>
<tr>
<td>Hydropower Civil Words—Procedures and Pitfalls</td>
<td>Albert M. Good</td>
<td>274</td>
</tr>
<tr>
<td>Experiences on Mini Hydro Feasibility Studies for Isolated Sites in Alaska and Malaysia</td>
<td>Gordon E. Little</td>
<td>284</td>
</tr>
<tr>
<td>Truckee-Donner PUD's Small-Scale Hydro at Boca Dam</td>
<td>Kenneth B. Peters and James C. Conwell</td>
<td>297</td>
</tr>
<tr>
<td>Standardized Design Components for Mini-Hydro Development</td>
<td>L. Lynn Pruitt</td>
<td>306</td>
</tr>
<tr>
<td>French Broad EMC's Capitola Project—3 MW with 14 Feet of Head</td>
<td>Thomas J. O'Neill</td>
<td>316</td>
</tr>
<tr>
<td>The Economical Solution of Low-Head Turbine Application from a Hydraulic Point of View</td>
<td>Peter Ulith and Franz Wolfram</td>
<td>325</td>
</tr>
<tr>
<td>Hydropower—Tailoring it to Fit</td>
<td>Orval W. Bruton</td>
<td>335</td>
</tr>
<tr>
<td>Estimating Micro-Hydro Potential in Western North Carolina, USA</td>
<td>Steven J. Berkowitz and Harvard G. Ayers</td>
<td>346</td>
</tr>
<tr>
<td>Recommended Activities in Small Hydropower Development—Lesotho</td>
<td>Bard C. Jackson and Martin L. Johnson</td>
<td>366</td>
</tr>
<tr>
<td>1000 MW to 5 MW—Thinking Small</td>
<td>W. Sayed</td>
<td>376</td>
</tr>
<tr>
<td>Assessing the Risk of Low Water</td>
<td>Carol H. Cunningham</td>
<td>383</td>
</tr>
<tr>
<td>Regional Assessment of Small Scale Hydropower—A Methodology for Developing Countries</td>
<td>Gordon E. Little</td>
<td>393</td>
</tr>
<tr>
<td>FINANCING, LICENSING, AND LEGAL ISSUES</td>
<td></td>
<td>405</td>
</tr>
<tr>
<td>FERC Cases on Municipal Hydroelectric Development</td>
<td>Robert A. Olson</td>
<td>406</td>
</tr>
<tr>
<td>The Battle for Municipal Preference</td>
<td>Robert S. Angyal</td>
<td>415</td>
</tr>
</tbody>
</table>