CONTENTS

PREFACE		vii
1.	INTRODUCTION	1
	List of Contributors to this Report	3
2.	ASSESSMENT OF THE CONVERTIBLE POTENTIAL OF WIND ENERGY IN COUNTRIES OF THE EUROPEAN COMMUNITIES	5
2.1	Distribution of Mean Annual Wind Speeds	5
2.2	Evaluation of the Sites and Conversion Potential	17
2.2.1	Description of the Method Used	17
2.2.2	Results of the Analysis	18
	 Potential for Small WECs 	
	 On-Land Potential for Large WECs 	
	- Off-Shore Potential for Large WECs	
2.3	Geographical Distribution of the Potential	25
2.4	Discussion of the Siting and Conversion Potential	34
3.	ASSESSMENT OF THE UTILIZATION POTENTIAL	37
3.1	General Aspects	37
3.2	Survey of the Existing Supply System and Electricity	0,
0.2	Consumption	37
3.3	Penetration Problems	41
	Limitation of Wind Energy Utilization by the	
	Existing Transmission Capacity	41
3.3.2	Aspects of the Combined Operation of Conventional and	
	Wind Power Stations	44
3.4	Conclusions	61
4.	STATE OF THE ART OF WIND ENERGY UTILIZATION	63
4. 4.1	Technical Maturity of Wind Energy Converters	63
4.1.1	Technology of Wind Energy Converters	63
4.1.2	Analysis of Commercially Available WECs	66
4.2	Integration of WECs in the Electricity Networks	75
4.2.1	General Aspects	75
4.2.2	Electrical Requirements for Small WECs	75
4.2.3	Safety Requirements for Small WECs	80
4.2.4		86
4.2.5	Problems of Island Operation of WEC and Diesel Systems	88
4.3	National Programmes	90
4.4	Involvement of Industry and Electricity Supply Boards	
	in Wind Energy	98
5.	ECONOMIC ASPECTS	102
5. 5.1	Analysis of the Costs of Existing WECs	102
5.2	-	102
5.2	Cost of Wind Energy in Decentralized Applications (private ownership)	107
	(bitvare ownership)	107

-



5.2.1	Energy Costs of Small WECs Connected to the Grid	107
5.2.2	Energy Costs of Small WECs without Grid Connection	109
5.2.3	Tariffs for Autoproducers	111
5.2.4	Public Financial Aids to Wind Energy	112
5.3	Allowable Costs of Wind Energy in Centralized	
	Applications	116
5.3.1	Costs of the Conventional Production of Electricity	116
5.3.2	Calculation Methods for Fuel Credit and Capacity Credit	119
5.3.3	Examples of the Allowable Costs for Wind Energy	
	Installations at Specific Locations in the EEC Countries	128
5.4	Discussion	130
6.	MAIN RESTRICTIONS ON WIND ENERGY UTILIZATION	132
6.1	Legal Constraints	132
6.2	Environmental and Safety Constraints	133
6.3	Economic Constraints	133
6.4	Technical Constraints	134
7.	CONCLUSIONS	135
7.1	The Prospective Value of Wind Energy	135
7.2	Recommendations for Future Research, Development and	
	Demonstration	135
7.2.1	Wind Potential	135
7.2.2	Siting Problems	135
	Penetration Problems	136
7.2.4	Machine Technology	136
	Pilot Plants	136
7.2.6	Demonstration Plants	137
7.2.7	Economic Aspects	137
Glossary		138
LIST O	F FIGURES	140
LIST O	F TABLES	144
REFERE	NCES	146