#### **EMBARGO**

The contents of this Report must not be quoted or summarized in the print, broadcast or electronic media before 29 November 2011, 17:00 hours GMT

## TECHNOLOGY AND INNOVATION REPORT 2011

Powering Development with Renewable Energy Technologies







# TECHNOLOGY AND INNOVATION REPORT 2011

Powering Development with Renewable Energy Technologies





#### NOTE

The terms country/economy as used in this Report also refer, as appropriate, to territories or areas; the designations employed and the presentation of the material do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. In addition, the designations of country groups are intended solely for statistical or analytical convenience and do not necessarily express a judgment about the stage of development reached by a particular country or area in the development process. The major country groupings used in this Report follow the classification of the United Nations Statistical Office. These are:

Developed countries: the member countries of the OECD (other than Chile, Mexico, the Republic of Korea and Turkey), plus the new European Union member countries which are not OECD members (Bulgaria, Cyprus, Latvia, Lithuania, Malta and Romania), plus Andorra, Bermuda, Liechtenstein, Monaco and San Marino.

Transition economies: South-East Europe and the Commonwealth of Independent States.

Developing economies: in general all economies not specified above. For statistical purposes, the data for China do not include those for Hong Kong Special Administrative Region (Hong Kong SAR), Macao Special Administrative Region (Macao SAR) and Taiwan Province of China.

Least developed countries: These refer to a group of 48 countries that have been identified as "least developed" in terms of their low GDP per capita, their weak human assets and their high degree of economic vulnerability.

The boundaries and names shown and designations used on the maps presented in this publication do not imply official endorsement or acceptance by the United Nations.

Symbols which may have been used in the tables denote the following:

- Two dots (..) indicate that data are not available or are not separately reported. Rows in tables are omitted in those cases where no data are available for any of the elements in the row.
- A dash (–) indicates that the item is equal to zero or its value is negligible.
- A blank in a table indicates that the item is not applicable, unless otherwise indicated.
- A slash (/) between dates representing years (e.g., 1994/95) indicates a financial year.
- Use of a dash (–) between dates representing years (e.g. 1994–1995) signifies the full period involved, including the beginning and end years.
- Reference to "dollars" (\$) means United States dollars, unless otherwise indicated.
- Details and percentages in tables do not necessarily add to totals because of rounding.

The material contained in this study may be freely quoted with appropriate acknowledgement.

UNITED NATIONS PUBLICATION
UNCTAD/TIR/2011
Sales No. E.11.II.D.20
ISSN 2076-2917
ISBN 978-92-1-112840-6
Copyright © United Nations, 2011
All rights reserved. Printed in Switzerland

PREFACE

#### **PREFACE**

As the evidence and impact of climate change increase, so does the urgency to develop new, clean ways of generating and using energy. And as global demand for energy increases, this quest will become even more urgent. This year the population of the planet reached 7 billion. By 2050 it may top 9 billion. All will need access to modern and affordable energy services.

The UNCTAD *Technology and Innovation Report 2011* focuses on the important role of renewable energy technologies in responding to the dual challenge of reducing energy poverty while mitigating climate change. This is particularly timely as the global community prepares for the Rio+20 Conference next year. The Report identifies key capacity issues for developing countries and proposes concrete recommendations for the wider use of renewable energy technologies to promote sustainable development and poverty reduction.

My high-level Advisory Group on Energy and Climate Change stressed that there is an urgent need to mobilize resources and accelerate efforts to ensure universal access to energy. Creating an enabling environment for the promotion and use of renewable energy technologies is a critical part of this effort, as recognized by the United Nations General Assembly when it declared next year as the "International Year for Sustainable Energy for All".

It is also at the heart of my recent launch of the Sustainable Energy for All initiative to help ensure universal access to modern energy services; double the rate of improvement in energy efficiency; and double the share of renewable energy in the global energy mix, all by the year 2030.

We can tackle both energy poverty and climate change by facilitating investment, enhancing access to technologies, and doing more to help developing countries make a transition to a greener path of economic growth. *The Technology and Innovation Report 2011* helps point the way forward.

BAN Ki-moon Secretary-General United Nations

Ki Mow Ban

#### **ACKNOWLEDGEMENTS**

The Technology and Innovation Report 2011 was prepared under the overall direction of Anne Miroux, Director of UNCTAD's Division on Technology and Logistics, and the direct supervision of Mongi Hamdi, Head, Science, Technology and ICT Branch.

The report was written by a team comprising Padmashree Gehl Sampath (team leader), Michael Lim and Carlos Razo. Inputs were provided by Dolf Gielen (Executive Director, IRENA Technology and Innovation Center, Bonn), Professor Mark Jaccard, Simon Fraser University, Professor Robert Ayres (INSEAD), Aaron Cosbey (IISD), Mathew Savage (IISD), Angel Gonzalez-Sanz (UNCTAD), Oliver Johnson (UNCTAD) and Kiyoshi Adachi (UNCTAD).

An ad hoc expert group meeting was organized in Geneva to peer review the report in its draft form. UNC-TAD wishes to acknowledge the comments and suggestions provided by the following experts at the meeting: Amit Kumar (The Energy and Resources Institute), Elisa Lanzi (OECD), Pedro Roffe (ICTSD), Ahmed Abdel Latif (ICTSD), Vincent Yu (South Centre), Taffere Tesfachew (UNCTAD), Torbjorn Fredriksson (UNCTAD) and Zeljka Kozul-Wright (UNCTAD). UNCTAD also acknowledges comments by the following experts: Manuel Montes (UN/DESA), Francis Yamba (Centre for Energy Environment and Engineering, Zambia), Aiming Zhou (Asian Development Bank), Youssef Arfaoui (African Development Bank), Mahesh Sugathan (ICTSD), Jean Acquatella (ECLAC) and Alfredo Saad-Filho (UNCTAD).

The report was edited by Praveen Bhalla and research assistance was provided by Fernanda Vilela Ferreira and Hector Dip. Nathalie Loriot was responsible for formatting and Sophie Combette designed the layout.

### **CONTENTS**

Note	ii
Preface	
Acknowledgements	
Contents	
List of abbreviations	
Key messages	
Overview	XV
CHAPTER I. RENEWABLE ENERGY TECHNOLOGIES, ENERGY POVERTY AND	CLIMATE
CHANGE: AN INTRODUCTION	
A. Background	
B. A new urgency for renewable energies	4
An energy perspective	
A climate change perspective	
3. A developmental perspective	
An equity and inclusiveness perspective	7
C. Energy poverty and a greener catch-up: The role of science, technology an	
policies	
Towards technological leapfrogging	
2. The crucial role of technology and innovation policies	10
3. Definitions of key terms	10
a. Energy povertyb. Renewable energy technologies	
<i>.</i>	
D. Organization of the Report	13
CHAPTER II. RENEWABLE ENERGY TECHNOLOGIES AND THEIR GROWING RO	DLE
IN ENERGY SYSTEMS	19
A. Introduction	21
B. Defining alternative, clean and renewable energies	22
The growing role of RETs in energy systems	
2. Limits of RET applicability	
3. Established and emerging RETs	28
a. Hydropower technologies	
b. Biomass energy technologies	29
(i) Traditional biomass	
(ii) Modern biomass for electric power	
(iii) First and second generation biofuels	
c. Wind energy technologies	31
d. Solar energy technologies	
(i) Concentrating solar power systems	
(ii) Solar thermal systems	
(iii) Solar photovoltaic technology	
e. Geothermal energy technology	
f. Ocean energy technologies	
g. Energy storage technologies	
Scenarios on the future role of RETs in energy systems	38

C. Trends in global investments and costs of RETs	39
Private and public sector investments in RETs	39
2. Costs of renewable energy and other energy sources compared	41
a. Problems with making direct cost comparisons	42
(i) Fiscal support by governments	
(ii) Factoring in costs specific to conventional energy: Subsidies and environmental externalities	42
(iii) Factoring in costs specific to RETs	42
b. Incorporating costs into the market price of energy options	
3. The evidence on renewable energy costs	44
D. Summary	48
CHAPTER III. STIMULATING TECHNICAL CHANGE AND INNOVATION IN AND	
THROUGH RENEWABLE ENERGY TECHNOLOGIES	53
A. Introduction	
B. Technology and innovation capabilities for RETs development: The context	
Key networks and interlinkages for RETs	57
a. Public science through public research institutions and centres of excellence	
b. Private sector enterprises	
c. End-users (households, communities and commercial enterprises)	
2. Linkages between RETs and other sectors of the economy	
C. Promoting a virtuous integration of RETs and STI capacity	
Addressing systemic failures in RETs	
Tipping the balance in favour of RETs	
a. Government agencies and the general policy environment	
b. Facilitation of technology acquisition in the public and private sector	
c. Promotion of specific renewable energy programmes and policies	
d. Attainment of grid parity and subsidy issues	
e. Promoting greater investment and financing options	
f. Monetizing the costs of energy storage and supply	
3. Job creation and poverty reduction through RETs	
D. Summary	
CHAPTER IV. INTERNATIONAL POLICY CHALLENGES FOR ACQUISITION, USE AND	
DEVELOPMENT OF RENEWABLE ENERGY TECHNOLOGIES	79
A. Introduction	81
B. International resource mobilization and public financing of RETs	
Financing within the climate change framework	
2. Other sources of finance	
3. International support for financing of RETs: Outstanding issues	
C. Technology transfer, intellectual property and access to technologies	
Technology transfer issues within the climate change framework	
2. Intellectual property rights and RETs	
a. The barrier versus incentive arguments	
b. Preliminary trends in patented RETs.	
Outstanding issues in the debate on intellectual property and technology transfer	
a. Beyond technology transfer to technology assimilation	97

CONTENTS

b. Assessing the quality – and not the quantity – of technology transfer	97
c. Exploring flexibilities and other options within and outside the TRIPS framework	98
D. The green economy and the Rio+20 framework	98
1. Emerging standards: Carbon footprints and border carbon adjustments	58
2. Preventing misuse of the "green economy" concept	100
E. Framing key issues from a climate change-energy poverty perspective	
Supporting innovation and enabling technological leapfrogging	
a. An international innovation network for LDCs, with a RETs focus	
b. Global and regional research funds for RETs deployment and demonstration	103
c. An international technology transfer fund for RETs	
d. An international training platform for RETs	
2. Coordinating international support for alleviating energy poverty and mitigating climate change	
Exploring the potential for South-South collaboration	
F. Summary	106
A. Introduction	
B. Enacting policies with RET components and targets	
C. Specific policy incentives for production and innovation of RETs	
Incentives for innovation of RETs	
a. Public research grants	119
b. Grants and incentives for innovation of RETs	119
c. Collaborative technology development and public-private partnerships	121
o. Odliaborative technology development and public-private partnerships	
d. Green technology clusters and special economic zones for low-carbon technologies	121
	121 123
d. Green technology clusters and special economic zones for low-carbon technologies	121 123 123
d. Green technology clusters and special economic zones for low-carbon technologies	121 123 123
d. Green technology clusters and special economic zones for low-carbon technologies	121 123 123 124
d. Green technology clusters and special economic zones for low-carbon technologies	121123124126127
d. Green technology clusters and special economic zones for low-carbon technologies	
d. Green technology clusters and special economic zones for low-carbon technologies	

### 预览已结束,完整报告链接和二维码如下:

https://www.yunbaogao.cn/report/index/report?reportId=5\_9830



