

SpringerBriefs in Energy

Energy Analysis

Series Editor

Charles A. S. Hall

For further volumes:

<http://www.springer.com/series/10041>

Roger Boyd

Energy and the Financial System

What Every Economist, Financial Analyst,
and Investor Needs to Know



Springer

Roger Boyd
Vice President (Retired), Bank of Montreal
Toronto, ON
Canada

ISSN 2191-5520 ISSN 2191-5539 (electronic)
ISBN 978-3-319-04237-4 ISBN 978-3-319-04238-1 (e-Book)
DOI 10.1007/978-3-319-04238-1
Springer Cham Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014930311

© Roger Boyd 2013

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Contents

1	The Nature of the Problem	1
	References	7
2	It Takes Energy to Get Energy	9
2.1	A Very Short History of Humanity and Energy Return on Investment	9
2.2	The Fossil Fuels: 86.6% of Human Society’s Energy Usage	14
2.2.1	Oil: EROI 18:1 and Rapidly Declining; 32.6% of Energy Usage (Excluding Ethanol and Biodiesel)	14
2.2.2	Coal: EROI 20-80:1 and Slowly Declining; 30.3% of Energy Usage	16
2.2.3	Natural Gas: EROI 10:1 and Declining; 23.7% of Energy Usage	17
2.3	Hydro and Nuclear: 11.3% of Global Energy Usage	19
2.3.1	Hydroelectricity: EROI 12:1 to 267:1 and Stable; 6.4% of Energy Usage	19
2.3.2	Nuclear: EROI About 5:1 with Large Uncertainties; 4.9% of Energy Usage	20
2.4	Non-Hydro Modern Renewable Energy: 2.1% of Global Energy Usage	21
2.4.1	Wind: EROI Averaging 18:1; Approximately 1% of Energy Usage	21
2.4.2	Biofuels: EROI of 1:1 to 18:1; Approximately 0.5% of Energy Usage	22
2.4.3	Solar: EROI Between 2:1 and 12:1; Less Than 0.5% of Energy Usage	23
2.4.4	Wave: EROI Not Available; Negligible % of Energy Usage	24
2.4.5	Geo-Thermal: EROI Not Available; Negligible % of Energy Usage	24
2.5	Summary	24
	References	26

- 3 It is the flow, stupid!** 29
 - 3.1 Introduction 29
 - 3.2 Oil: Probably Already Peaked, Declining Soon? 31
 - 3.3 Natural Gas: More Flow Possible and Some Substitution for Oil as a Transport Fuel 34
 - 3.4 Coal: The Old Workhorse Still has Something Left 36
 - 3.5 Hydroelectricity: Small Increases Possible 38
 - 3.6 Nuclear: New Capacity Significantly Offset with Retirements 38
 - 3.7 Wind Could Provide a Useful Percentage of Energy Needs 41
 - 3.8 Bio-Fuels: From Really Small to Small 42
 - 3.9 Solar: From Tiny to Really Small 44
 - 3.10 Wave: Really Tiny to Perhaps Tiny 44
 - 3.11 Geo-Thermal: Really Tiny, Unless You Live in Iceland 45
 - 3.12 Summary 45
 - References 48

- 4 A Financial System Addicted to Exponential Growth** 51
 - 4.1 Introduction 51
 - 4.1.1 Limitations on Energy Availability 51
 - 4.1.2 The Financial System as a Time Machine 53
 - 4.2 Share Prices 56
 - 4.3 Bond Prices 57
 - 4.4 Mutual Funds 59
 - 4.5 Pension Funds and Annuities 58
 - 4.6 Insurance Companies 60
 - 4.7 Bank Lending 60
 - 4.8 Investment Decisions 62
 - 4.9 Summary 62
 - References 64

- 5 So What Can I Do?** 67
 - 5.1 Introduction 67
 - 5.2 Reducing Exposure to Fictitious Assets 68
 - 5.3 Location, Location, Location 70
 - 5.4 Outlook for Change: Cognitive Dissonance, Vested Interests, and Inertia 73
 - 5.5 Nature of Collapse 75
 - 5.6 Summary 77
 - References 77

- Index** 79

About the Author

Roger Boyd is a retired financial industry executive, where he worked for 25 years. He received a BSc in Information Systems from Kingston University in England, an MBA in Finance from Stern School of Business, New York University in the United States, and an MA in Integrated Studies from Athabasca University in Canada. Over the past decade he has taken a deepening interest in the way in which modern societies, especially their financial systems, will deal with global threats such as energy constraints and climate change. He also maintains a blog covering such issues, www.humanitystest.com.