



Lecture 6: Financing the Transformation

Episode 1: Investment requirements, financing options and investment barriers

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Episode 1: Financing the transformation: Investment requirements, financing options and investment barriers (Prof. Dr. Renate Schubert)

Episode 2: Financing the transformation: The role of carbon markets (Dr. Daniel Klingefeld)

Episode 3: Interview



1. You get an idea of size and structure of investment requirements for the global transformation and especially the energy transformation
2. You know the advantages of the energy transformation
3. You know the basic options and actors for financing the energy transformation
4. You understand the barriers for financing the global energy transformation
5. You know specific financing and investment barriers in developing countries
6. You are aware of solutions for overcoming the financing and investment barriers



Investment requirements and advantages

- Investment requirements
- Societal benefits of the energy transformation
- Advantages of the energy transformation

Financing the energy transformation

- Financing options and actors
- Main barriers to investment and financing
- Specific barriers in developing countries
- Recommendations for financing the energy transformation

Conclusions



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The global transformation requires above all investments into...

- Research and development of new technologies (R&D)
- Technology diffusion
- Energy-efficient agricultural and industrial production technologies
- Communication and transport systems
- **Expansion of renewable energy production, energy grids and energy storage capacities**
- **End-use efficiency (mobility, housing, communication)**



Investment requirements for the energy transformation

Global energy-related investments today (2010):

~ 1.3 trillion US-\$ per year

Required future investments in the global energy sector

(based on a scenario with strong expansion of renewable energies, no use of nuclear power, increased energy efficiency, and with access to modern energy for all; GEA 2012)

- ~ 2 trillion US-\$ per year (2030)
- ~ 3.5 trillion US-\$ per year (2050)

→ 68 trillion in total US-\$ between 2010 and 2050



Investment requirements per region

- North America, the European Union and China account for ~ 60% of the total investment requirements up to 2030
- Shift of investment requirements to newly industrializing countries by 2030 due to rising demand for consumer goods and energy

Regional share of global investment requirements	up to 2015	up to 2030
North America	~ 22%	~ 17%
European Union	~ 22%	~ 17%
China	~ 18%	~ 26%

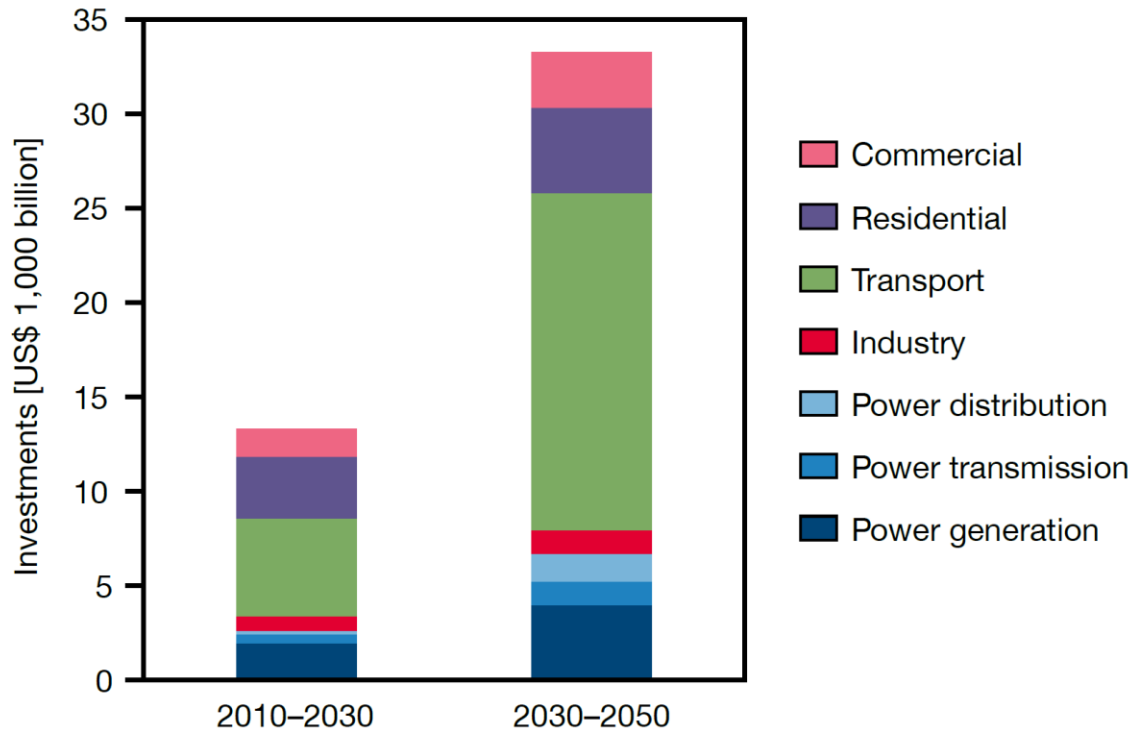
Source: McKinsey (2009)

- Investment needs in developing countries: 260 to 560 bio. US-\$ annually up to 2030 (including 36-48 bio. US-\$ for energy access)



Investment requirements per sector

- The highest share of investments is needed in the transport and (commercial/residential) buildings sectors (IEA 2010/2011)



Source: Breakdown of investment requirements for the various sectors in US-\$; IEA, 2010



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Many societal benefits of the energy transformation

- Access to modern energy services for 3 billion people
- Fuel savings
- Reduced costs for air pollution control
- Reduced health- and environment-related expenditure
- Reduced climate change adaptation costs
- Increased energy security and independence from fuel imports
- Development of innovations and new sectors → employment opportunities, etc.



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The energy transformation offers various advantages

- Because of societal benefits, the “net costs” of the energy transformation are much lower than the “gross costs”
- Due to operating cost savings from reduced fossil/nuclear energy systems the investment costs of the energy transformation with more renewable energy and higher energy efficiency can be payed back until 2040
- It seems worthwhile financing the global energy transformation and especially the decarbonization of global energy systems



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Actors and financing options

Parties supplying capital (Capital Investors)	Parties seeking capital (Investors)	Intermediaries
Governments	Governments	Commercial banks
Venture capitalists	Private companies, e.g. industry, utilities, energy project developers	Development banks
Private equity providers		
Institutional investors, e.g. Sovereign Wealth Funds, pension funds, insurance companies, foundations, family offices	Network operators	
Retail investors (private households)	Private households	

Source: after WBGU, 2012



Estimated resources of different actors

Governments

- Estimated financial assets: ~ 18.7 trillion US-\$ (McKinsey, 2011)
- Potential new sources: tax revenues, revenues from emissions trading, savings from phasing out fossil fuel subsidies, etc.

Private companies and households

- Estimated financial assets: ~ 179.4 trillion US-\$ (McKinsey, 2011)

International financing organisations / Climate and development finance

- Estimated spending for energy projects: <10 billion US-\$ annually
- Leverage ratios: typically around 3:1 or 4:1, up to 15:1



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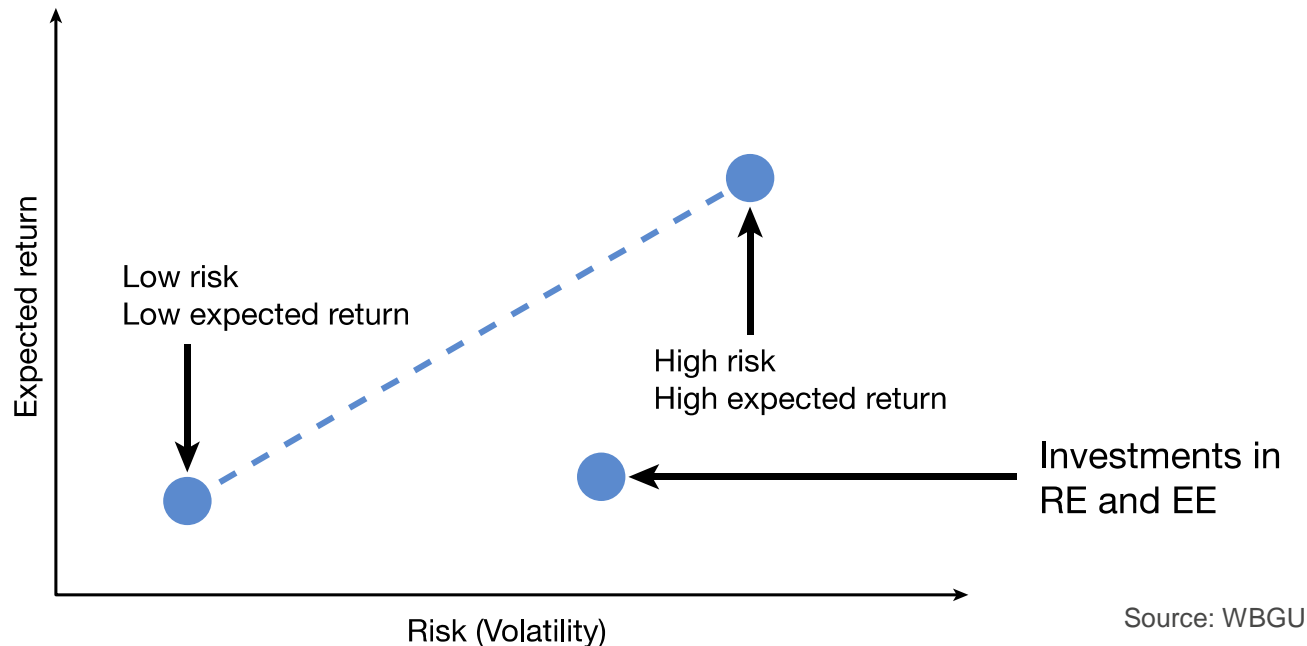
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Risk-return ratio as barrier

- Investment decisions usually trade off risk and return of an investment



- Problem: Investments in renewable energy (RE) and energy efficiency (EE) are often characterized by both, high risk and low returns → they do not qualify for de facto investments

General Barrier: Overall policy framework (1)

- **Lack of stringent, long-term and (legally) binding energy and climate policies** in most countries, including energy goals, energy strategies and emission reduction targets

Investors need transparency, longevity and certainty (esp. protection of trust, protection of continuance).

Without stringent and binding energy and climate policies, investment risks remain too high.



General Barrier: Overall policy framework (2)

- **Externalization of societal costs of fossil fuels/nuclear energy:**
Societal costs of CO₂ emissions or nuclear accidents are not included in fossil/nuclear energy prices
- **Subsidies for fossil (and nuclear) fuels:** around 410 billion US-\$ demand-side subsidies for fossil fuels in 2010

Externalization of societal costs of fossil fuels and fossil fuel subsidies reduce competitiveness of renewable energies and keep (fossil/nuclear) energy prices low

- low return of renewable energy investments
- low attractiveness of energy efficiency investments



Specific barriers for energy investments

- **High-upfront capital requirements and long pay back periods:** capital requirements are high and capital is locked in for 10 to 40 years, while investment horizons of most investors are much shorter
- **High technology risks:** RE and EE technologies are often new and have to be tested for longer time periods
- **High resource risks:** sunshine and wind show high fluctuations
- **High market risks:** development of prices and market demand is uncertain
- **High transaction costs:** projects are often low scale, but require huge effort for data collection, due diligence and administrative procedures



Specific barriers for investments in grids and energy efficiency

- **Existing grid regulations:** grids are natural monopolies and require government regulation; existing regulations often do not allow passing on investment costs to network charges → **low incentives for grid expansion**
- **Information asymmetries:** investors know more about potential energy savings than capital suppliers → **capital suppliers do not trust in energy saving potentials**
- **Inappropriate institutional structures:** Example: Landlords have to pay for energy efficiency measures in buildings, while tenants profit from day-to-day energy savings → **low investment incentives**



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Additional investment barriers in developing countries

- **Lack of political and economic pre-conditions for foreign direct investment: investors** expect political stability, legal certainty, a functioning financial and banking sector and international investment agreements → many developing countries do not offer this
- **Low scale of many RE and EE projects:** low scale projects cause prohibitively high transaction costs → low investment incentive
- **Lack of solvent electricity customers:** many households cannot afford regular power supply → low investment incentive
- **Limited funds from development and climate finance:** small shares for transformative RE and EE projects → lacking finances



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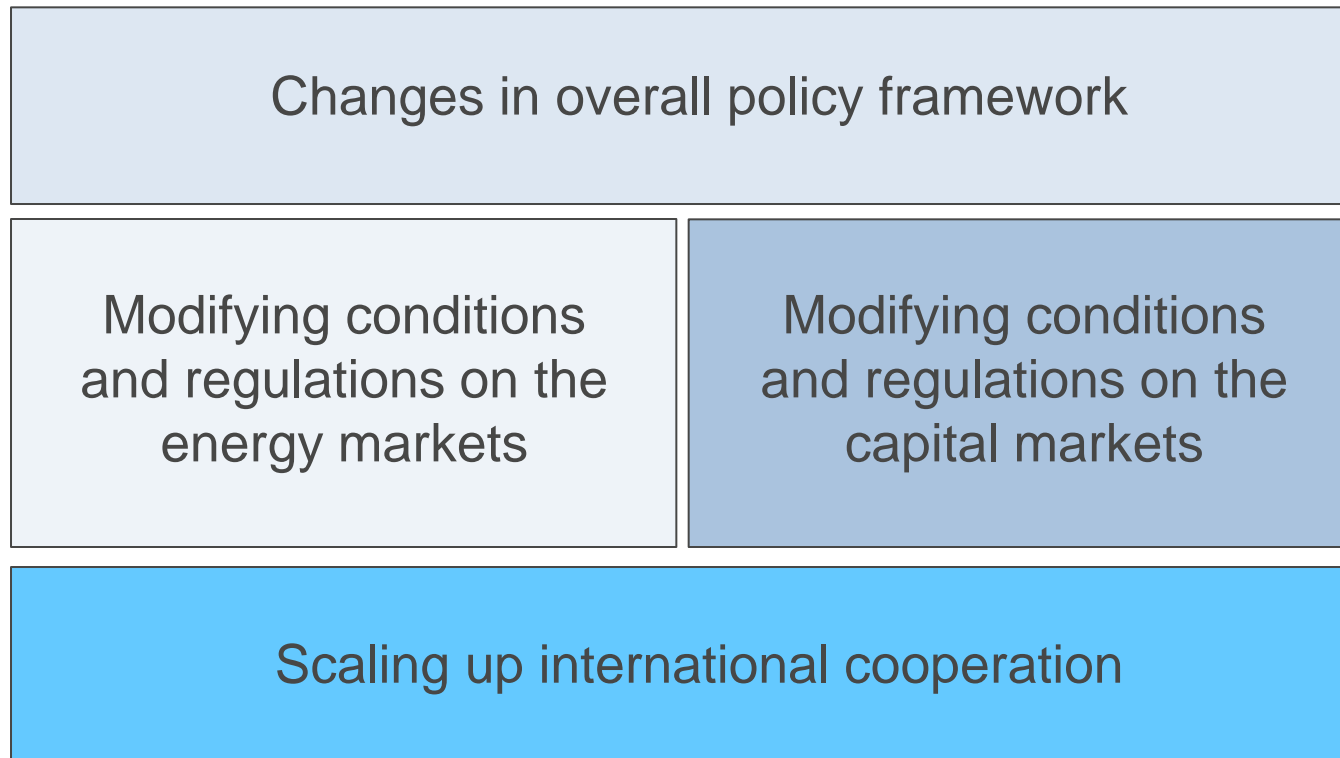
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Classification of recommendations



Source: after WBGU, 2012



Changes in the overall policy framework

- **Defining long-term, reliable energy strategies**, as has been done by Germany, Denmark, Sweden, the UK etc. **risk ↓**
- **Guaranteeing legal security to investors** **risk ↓**
- **Internalizing societal costs of fossil fuels and nuclear energy**, e.g. by putting a price on CO₂ emissions and by increasing the liability of nuclear power plant owners **return ↑**
- **Abandoning fossil fuel subsidies**: phasing-out all demand- and supply-side fossil fuel subsidies **return ↑**



Reducing investment barriers in energy markets (1)

- **Promoting RE investments through feed-in tariffs:** introducing temporary feed-in tariffs for renewable energy to guarantee returns and thus support technology diffusion **risk ↓ return ↑**
- **Allowing market integration of renewables:** improving the electricity market design, for instance by bringing RE into conventional electricity markets via temporary market premiums **risk ↓ return ↑**
- **Setting incentives for grid expansion,** e.g. through allowing increased network charges **return ↑**



Reducing investment barriers in energy markets (2)

- **Creating dynamic efficiency standards:** for instance by following the Top-Runner principle (taking the efficiency of the best product in class as overall industry standard) **risk ↓**
- **Promoting research and development:** renewable energy technologies (esp. energy storage technologies) still have to be improved and households' energy demand determinants have to be identified **risk ↓**



Reducing investment barriers in capital markets (1)

- **Setting up national development banks or «Green Investment Banks»**, providing
 - Information, e.g. consulting services, databases for capital investors **risk ↓**
 - Capital at preferential conditions, e.g. preferential credits, credit lines **return ↑**
 - Further risk mitigation options, e.g. funds in Public Private Partnership, credit guarantees, energy savings insurances, weather derivatives etc. **risk ↓**



Reducing investment barriers in capital markets (2)

- **Adapting financial market regulation:** reducing disadvantages for long-term investments in accounting standards; aligning management and compensation schemes to long-term goals **risk ↓ return ↑**
- **Supporting venture capital markets:** creating favorable fiscal conditions for transformative energy-related venture capital funds **risk ↓**
- **Supporting new business models:** for example Energy Services Companies ESCOs (energy contracting), citizens' energy cooperatives etc. **risk ↓**



Reducing specific investment barriers in developing countries

- **Creating Market Facilitation Organizations:** reducing transaction costs for investors **risk ↓ return ↑**
- **Supporting strategic energy partnerships:** cooperation between (newly) industrialized countries and developing countries **risk ↓**
- **Enhancing access to capital:** scaling-up risk management tools of international financing organizations (like International Financing Corporation, IFC); Multilateral Investment Guarantee Agency (MIGA) **risk ↓**
- **Strengthening international organizations:** coordinating the global energy transformation (UN-Energy; International Renewable Energy Agency, IRENA) **return ↑**



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The global (energy) transformation has to be and can be financed

- There are huge investment requirements for a global (energy) transformation
- There seems to be enough private capital available for financing these requirements
- Investment and financing barriers make the transformation slow
- The overall policy framework as well as energy and capital market conditions have to be adjusted so that the risk-return ratio of investments into the global (energy) transformation becomes attractive in industrialized, emerging and developing economies



Exercises for self study

1. Why is the risk-return ratio of investments in technologies for renewable energy or energy efficiency worse than for investments in conventional energy technologies?
2. How important is government money as compared to private money in order to move societies towards sustainable low-carbon societies?
3. Which role do you see for international financing institutions with respect to the global transformation (of energy systems)?



Basic reading:

- WBGU (2011): World in transformation: A Social Contract for Sustainability, chapter 4. Berlin. www.wbgu.de
- WBGU (2012): Policy Paper 7. Berlin. www.wbgu.de

Further reading:

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- World Bank (2010): Making the Most of Public Finance for Climate Action. Issues Brief 2. Washington, DC: World Bank.

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