LABORATORY FOR ENERGY POLICY

RES Project Implementation: a Review of Best Practice in EU

As.Prof. Andrej Gubina, PhD.

University of Ljubljana, Faculty of Electrical Engineering
Trzaska cesta 25, SI-1000 Ljubljana, Slovenia
Email: andrej.gubina@fe.uni-lj.si

LABORATORY FOR ENERGY POLICY

RES Best Practice in EU

- Introduction: VBPC-RES Project
- Barriers of RES Penetration
- Project Implementation
- Best Practice – Main Drivers
- Examples of Best Practice
- Recommendations

VBPC-RES Project: 6.FP

- The Virtual Balkan Power Center for Advance of Renewable Energy Sources in W. Balkans (VBPC-RES Project, INCO-CT-2004-509205)
  - 17 partners from 11 countries from EU and Western Balkan regions.
  - EU Framework Program 6, EC, DG RTD and INCO.
  - Duration: January 2005 - December 2007.
  - Coordinator: University of Ljubljana, Faculty of Electrical Eng., Slovenia.
- The VBPC-RES project has the following main objectives:
  - Transfer of know-how in RES technologies and policy building
  - Their implementation for isolated regions.
  - Identification of main factors influencing investment decisions in RES,
  - Building of awareness on technologies, means and benefits of RES.
- Web-site of the project:
  - www.vbpc-res.org
- Project Coordinator's Office:

As. Prof. Andrej Gubina
Faculty of Electrical Engineering
Trzaska c. 25, SI-1000 Ljubljana, Slovenia
Tel.: +386 1 4768 830
Fax.: +386 1 426 46 51
E-mail: andrej.gubina@fe.uni-lj.si

Introduction

- RES projects are gaining on importance
  - Diminishing EU dependence on imported fossil fuel (oil and gas)
  - Meeting Kyoto protocol obligations
- New, stimulative policy development
  - Green paper on Security of Supply, March 2006
  - Energy Policy for Europe, January 2007
- Best Practice
  - Common traits that make a successful project
  - Possible guidelines are presented
  - Focus on best practice that exists within a technology

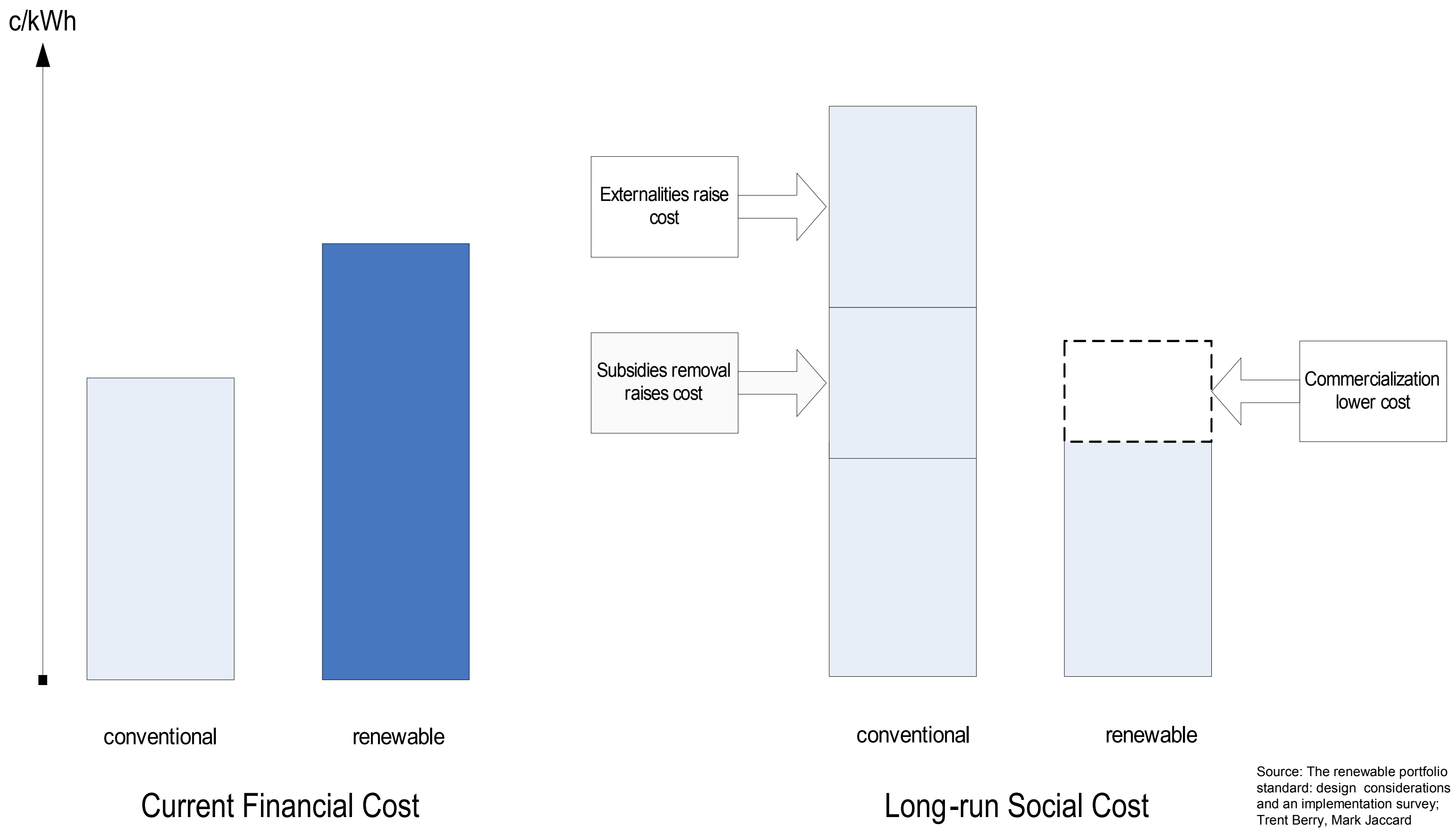
Barriers to RES Penetration

- Market Failure
  - Incumbents create barriers for newcomers
  - Technology is not freely available on the market
  - Investment requirements are high
- Market Distortion
  - Inconsistent pricing structures
  - Favorable treatment of conventional energy
    - externalities not considered (pollution, GHG emissions etc.)
- Economic and Financial Barriers
  - Credit market underdeveloped
  - Poor credit rating, lack of financing instruments, regulation
- Institutional Barriers
  - Complicated procedures, red tape, incompetence, corruption
  - Governmental policies: uncertain, unsupportive to RET…

Barriers to RES Penetration

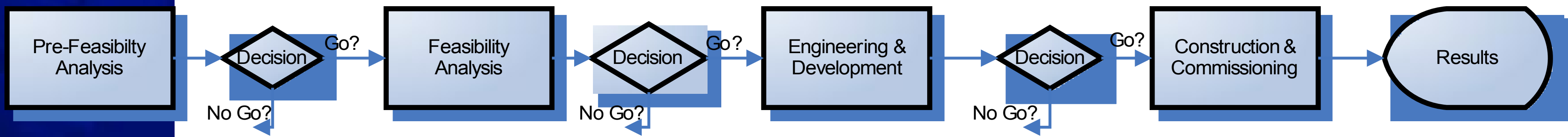
- Technical Barriers
  - Grid capacity limitations,
  - Low quality of equipment,
  - Standards missing/inadequate
- Social, Cultural and Behavioral Barriers
  - Lack of information → fear of unknown
- Other Barriers – investors, public
  - Uncertain regulatory policies
  - High risk perception
  - Disturbing environmental aspects
- Barriers may vary
  - across technology and between countries;
  - each RET project has specific barriers, solutions and results.

Conventional vs. Renewable Electricity: Financial and Social Comparison



Source: The renewable portfolio standard: design considerations and an implementation survey; Trent Berry, Mark Jaccard

Project implementation - Typical steps



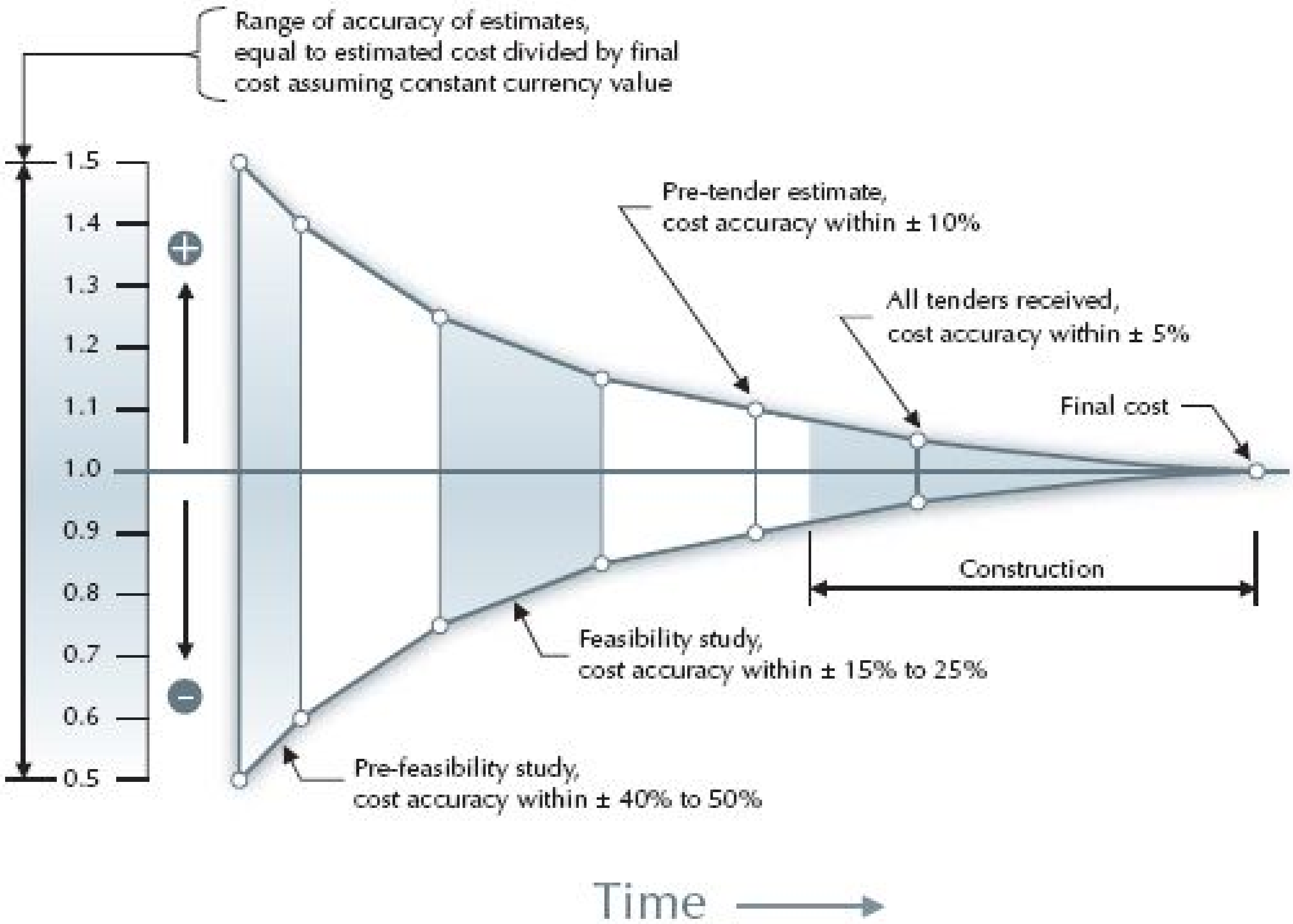
- Pre-feasibility analysis
  - quick and inexpensive initial examination
  - readily available site- and resource data, coarse cost estimates
- Feasibility Analysis
  - physical char., financial viability, + other impacts of the project,
  - decision whether to proceed with the project.
  - site investigation, energy auditing, simulation, equipment prices.
- Engineering and Development
  - Engineering: design and planning of project’s physical aspects
  - Development: planning, arrangement, and negotiation of financial, regulatory, contractual and other nonphysical aspects of the project.
- Construction and Commissioning

Project implementation

- Checklist for financing the project
  - Prepare project profile:
    - regulations, market, benchmark with similar projects
  - Economics: Foresee all costs and revenues,
    - budgeting, cash flow, financing plan/timetable
  - Secure legal status: permits, licences
  - Prepare engineering/feasibility study
  - Perform comprehenive risk analysis
    - credit-, construction-, market-, operating-, financial and political risk; adequate insurance policy is needed.

- Best practice strategy:
  - Set the goals and follow them,
  - Foresee the barriers, and overcome them
  - Prepare documentation and be throrough
  - Successfully conclude the project.

Accuracy of Project Cost Estimates vs. Actual Costs



Source: RETScreen Int.

LABORATORY FOR ENERGY POLICY

Best Practice – Project Components

- Project Theory and Design
  - Know: technology, market, management procedures
- Project Management
  - Project Management
  - Project Reporting & Tracking: participation, budget, market
  - Quality Control & Verification
- Project Implementation
  - Outreach/Marketing/Advertising
  - Participation Process & Customer Service
  - Installation and Delivery Mechanism
- Evaluation and Adaptability
  - Cross-Cutting Outcome Metrics
    - Cost Effectiveness Indicators ($/kWh or $/kW Saved)
    - Net Penetration Rates, Participant Adoption Rates,…
    - Sustainability/Market Effects on the project outcome.

Best Practices - Examples

- Small Hydro
  - Hannover, Herrenhausen Mini-Hydro Plant
  - Small Hydro Plant at Anatoliki
- Biomass
  - Admont, Biomass-Fired CHP Plant Based On An ORC Process
  - Ried im Innkreis, Fischer/Facc Biomass Tri-Generation Plant
- Wind Energy
  - Development of Wind-Turbine and Blade Technology in Greece
- Solar Thermal
  - Eibiswald, Solar Thermal Collector Integrated With a Biomass Plant
- Solar Photovoltaic
  - Installation of 60 kWp Modular PV System on The Greek Island of Sifnos
- Geothermal
  - Erding, Geo-Heating Plant

Best Practices Examples – Small Hydro

- Hannover, Mini-HPP: 470 kW, 2x kaplan, H_g = 2,1 m
  - Power utilization factor 86 % - 92.5 %.
    - Average production 4800 kWh/a.
  - Total investment €5.1m – turbines €1m, loan
    - O&M € 51,000/a, sales: € 96,000/a
  - Minimal environmental impact
    - overall design, features (e.g. fish ladder).

- SHPP at Anatoliki: 700 kW, pelton, H = 210 m
  - Target production 4 GWh.
  - Total cost €1.03m, 45 % capital subsidy.
  - Eligible auxiliary cost must not exceed 15 % of the total budget.

Best Practices Examples - Biomass

- Biomass-Fired CHP Plant ORC, Admont: 2,25 MW_{th}, 400 kW_e
  - first EU demonstration of a BM-ORC
    - Thermal boiler: sawdust, wood residues
  - Investment: €3,200,00;
    - 46 % Austrian Kommunalkredit AG + EC Joule Thermie Programme.
    - Payback period estimated to 7 years.
  - New BM- CHP system tech. standard.

- Biomass Tri-Generation Plant, Ried im Innkreis, Fischer/Facc
  - Electricity, heat and cooling for process, production hall and the offices.
  - Won Energy Globe Award 2001
  - Investment €5m: 65 % own financing
  - Payback period est. at 15 years.

Best Practices Examples – Wind, Geothermal

- Wind-Turbine Development, Greece
  - Project to enhance national technology in wind energy, esp. Wind Turbine (WT).
    - WT controllers and WT rotor blades
  - Investment: € 1,92m; over 70 % public funding.
    - Two partners are capable of producing WT parts, therefore lowering the cost of purchasing and installing wind turbines.
    - Lower start-up costs, more investments flowing in

- Geo-Heating Plant, Erding
  - Production: 28,000 MWh annually
  - Investment (heat acquisition, distribution): €15m
    - State of Bavaria covered 50 % of well equipment
    - EU: 40 % of cost for absorption heat pump

Best Practices Examples - Solar

- Solar Thermal Collector coupled to BM, Eibiswald, ‘91
  - waste wood for BM boiler,coupled with a supporting solar thermal collector system.
  - Investment: € 276 per m2 of STC = € 343,000.
    - Partly own financing, Austrian government and Styria state.
  - Solar: 516 MWh_t/a, heat production cost
    - € 0.05 per kWh (without subsidy)
    - € 0.03 kWh (with subsidy).
- Solar PV: 60 kWp System on Greek Island of Sifnos
  - Diesel generator -> PV plant
  - Centralized system, modular approach
    - future replication, different size plants
    - enable system implementation in a distributed configuration.

Recommendations

- Examine similar past projects
- Foresee the barriers
- Implement good project management
  - Pre-Feasibility study
  - Feasibilty study
  - Engineering and development
  - Construction and commissioning
- Follow the project milestones
- Ensure good public outreach
- Prepare for new technologies and market changes
- Courage! Just do it!

LABORATORY FOR ENERGY POLICY

References

- Balkan Power Center Report, Vol 2 (2006), No 2, D.11 – RES Projects Implementation. Proceedings of the VBPC-RES WP1, Workshop T.1.4., University of Zagreb, Croatia, 2005, www.vbpc-res.org
- Painuly J.P., *Barriers to renewable energy penetration; a framework for analysis*, Renewable Energy 24 (1) (2001) pp. 73-89.
- Berry T. and M. Jaccard, *The Renewable Portfolio Standard: Design Considerations and an Implementation Survey.* Energy Policy 29 (2001): pp. 263-277.
- RETScreen International, Clean Energy Decision Support Centre: *Introduction To Clean Energy Project Analysis*; ISBN: 0-662-39191-8; www.retscreen.com
- Power Project Financing S.P. and LLC: *Power Project Financing Checklist*. http://www.powerprojectfinancing.com/checklist.html
- Quantum Consulting: *National Energy Efficiency Best Practices Study: Volume M – Methodology*; http://www.eebestpractices.com/index.asp
- European Commission, DG-Energy and Transport: *Best Practice Projects Yearbook (1997 – 2000)*: December 2002; Contract Nº NNE5/2000/126. http://europa.eu.int/comm/energy/res/publications/yearbook_en.htm
- U.S. Agency for International Development, Office of Energy, Environment & Technology: *Best Practice Guide: Economic & Financial Evaluation Renewable Energy Projects,* June 2002.
- Finnish Funding Agency for Technology and Innovation; OPET network reports on bioenergy: http://www.tekes.fi/opet/bnetworkrep.htm

Questions?

As.Prof. Andrej Gubina, PhD.

Laboratory of Energy Policy
University of Ljubljana, Faculty of Electrical Engineering

andrej.gubina@fe.uni-lj.si