IRENA Workshop
Accelerated Renewable Energy Deployment in Islands with Emphasis on the Pacific Islands

Costs of Renewables in Pacific Island Countries (PICs)

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Presentation Plan

- Intro on RE and the Pacific
  - Resource available & limitations
  - Relevant RE Technologies
  - Why is information on costs important
- Cost data from RE projects in the Pacific
- Data gaps – some ideas
- Conclusions

What does the Pacific need from Renewable Energy?

- PICs need to gradually diversify their energy portfolio – almost all are 99% dependent on diesel
- Proven, reliable technologies that can be implemented today to reduce dependence on fossil fuels and increase reliability and access
- Solutions adapted to the Pacific economic, environmental, geographic and cultural context
- Systematic supporting mechanisms to build capacity before, during and after installation of RE infrastructure and to provide O&M in the long-term

Which RE? Some issues specific to PICs

- Limited RE resources and measured data
- Limited land availability and access
- Harsh environmental conditions and severe meteorological hazards (tsunamis / cyclones)
- Long distance supply chains and limited / unpredictable sea and air transport
- Limited human resources in energy sector vs growing demand for energy services
- Small markets / small private sector
- Limited capital investment available

Summary of resource potential

Country	Solar	Wind [a]	Biomass	Hydro	Geothermal	OTEC	Wave [a]
Cook Is	✔ ✔ ✔	✔ ✔	✔ ✔			✔ ✔	✔
FSM	✔ ✔	✔	✔ ✔	✔ ✔	✔ ✔	??	??
Fiji	✔ ✔	✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔	✔ ✔
Kiribati	✔ ✔ ✔	unlikely	✔			✔ ✔	??
Marshall Is.	✔ ✔ ✔	✔	✔			✔	
Nauru	✔ ✔ ✔	unlikely	✔			✔ ✔	
Niue	✔ ✔ ✔	✔ ✔	✔			??	??
Palau	✔ ✔ ✔	✔	✔ ✔			??	
PNG	✔ ✔	✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔	??	
Samoa	✔ ✔	✔ ✔	✔ ✔	✔ ✔	✔ ✔	??	??
Solomon Is.	✔ ✔	✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔	??	??
Tonga	✔ ✔ ✔	✔ ✔	✔			??	✔ ✔
Tuvalu	✔ ✔	unlikely	✔ ✔			??	??
Vanuatu	✔ ✔	✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔	??	??

Source: Adapted from Johnston, 1995

Renewable Technologies – so what's relevant right now in the PICs?

- Solar Water Heating
- Solar PV
- Wind
- Hydro
- Biomass / biofuels / biogas (not proven in PICs)
- Geothermal (remote and very capital intensive)
- Hybrids – remote applications & mini-grids

Why is information on cost important?

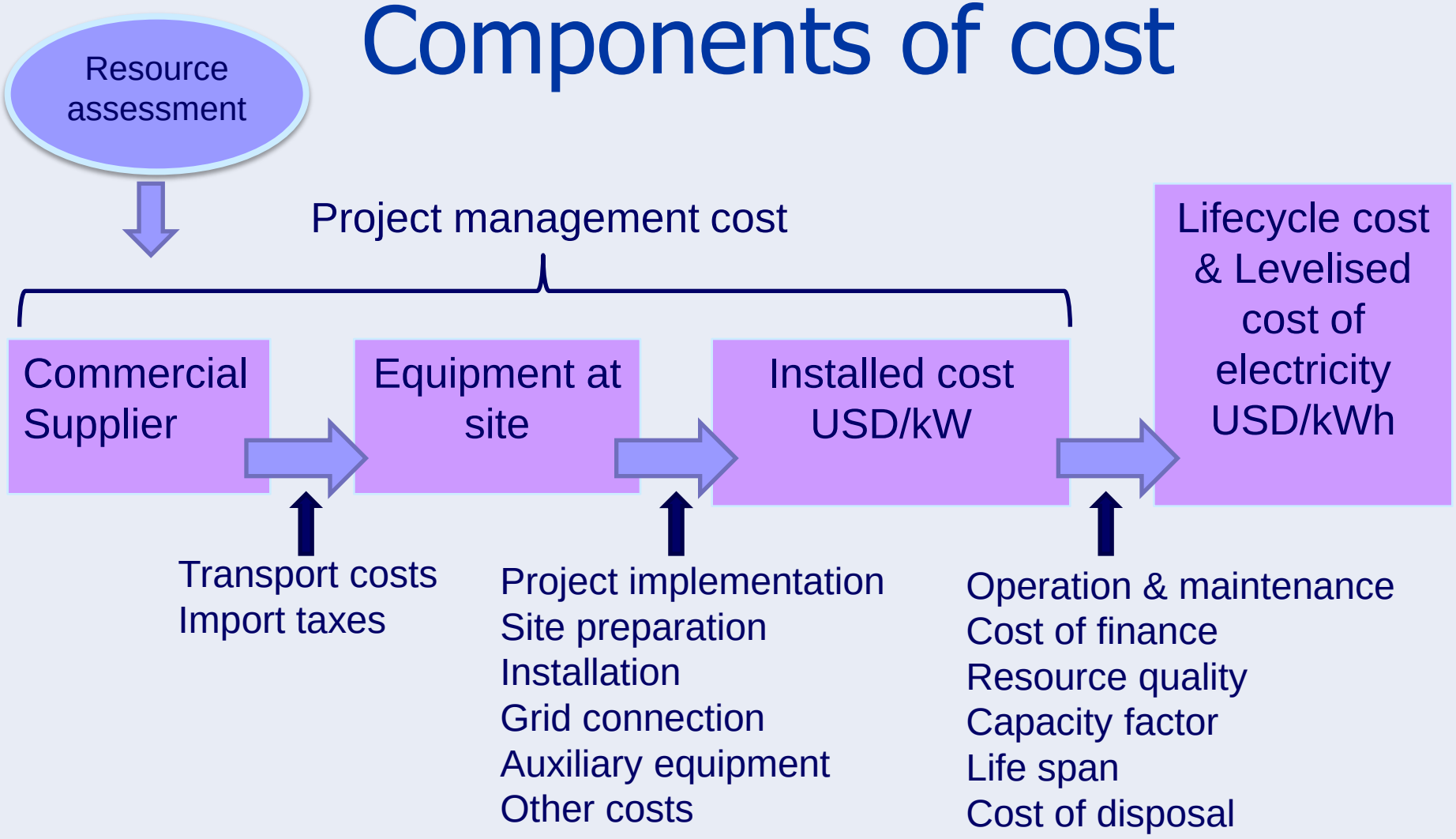
- Economic and finance information is a decision-making tool for Governments, utilities and private sector investors in RE
- The cost of renewables have declined rapidly in recent years = opportunity...*but information on real, on-site costs of RE technologies in the Pacific is very limited*

Cost information available in the Pacific to date

- Data is not systematically collected and/or is difficult to access from utilities and private sector
- A lot of RE projects done by tendering – data on costs is confidential and/or there is no breakdown
- Cost figures date back a few years
- Decision making is often based on outdated numbers or on international data which does not take into account particularities of Pacific

Costs from RE programmes and projects in the Pacific

Components of cost



Collecting cost data –complexities

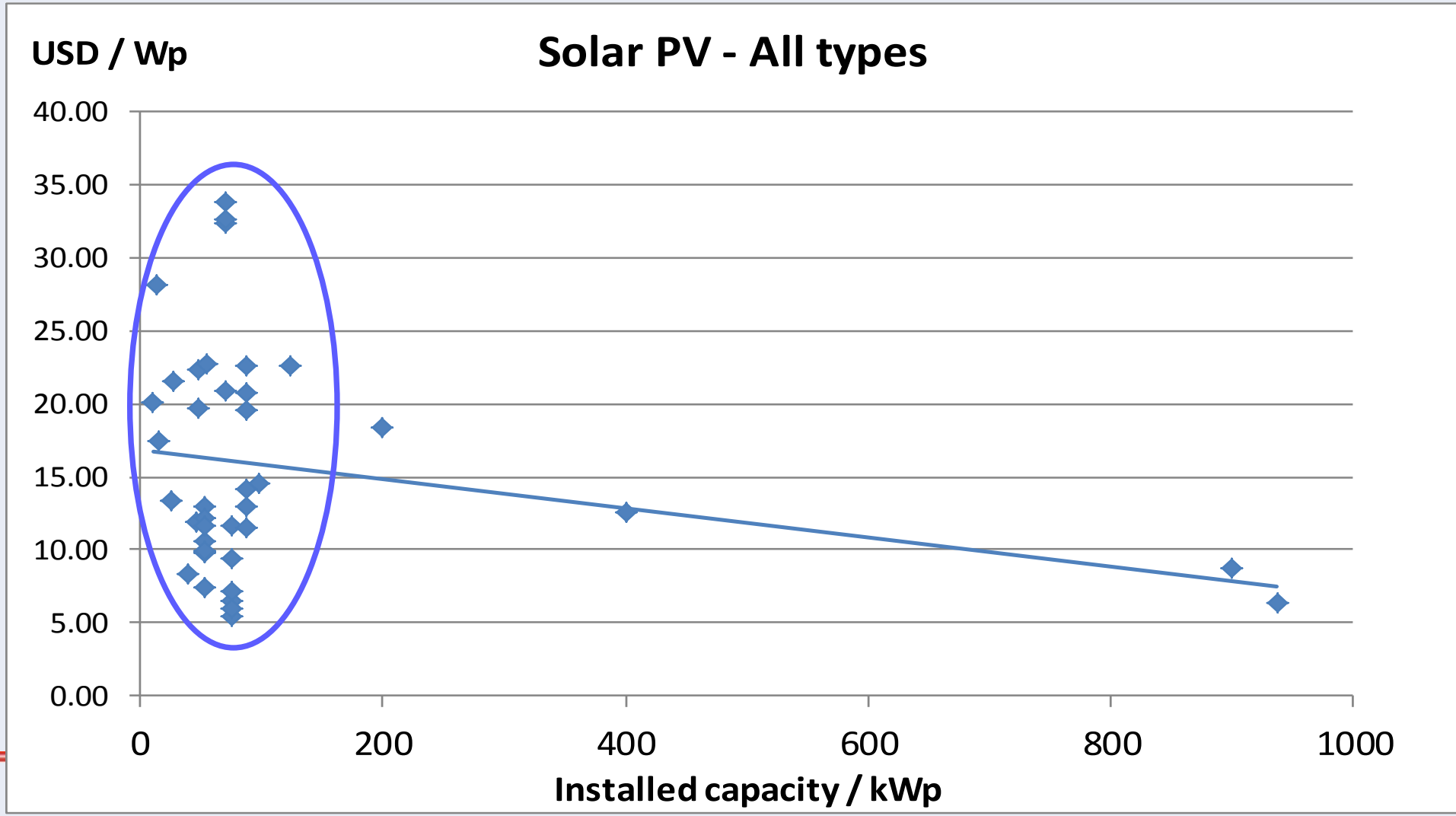
- Cost figures are often not fact based and therefore coloured by opinion or assumptions of the author
- Cost are sometimes hard to breakdown between components: equipment, labour, logistics, tax, etc.
- Cost data vary by project, country & over time
- Not all costs have been calculated the same way – assumptions, inclusions, exclusions
- A lot of info available on solar PV, not much on other RE technologies
- Capital costs available – less data on O&M / Lifecycle

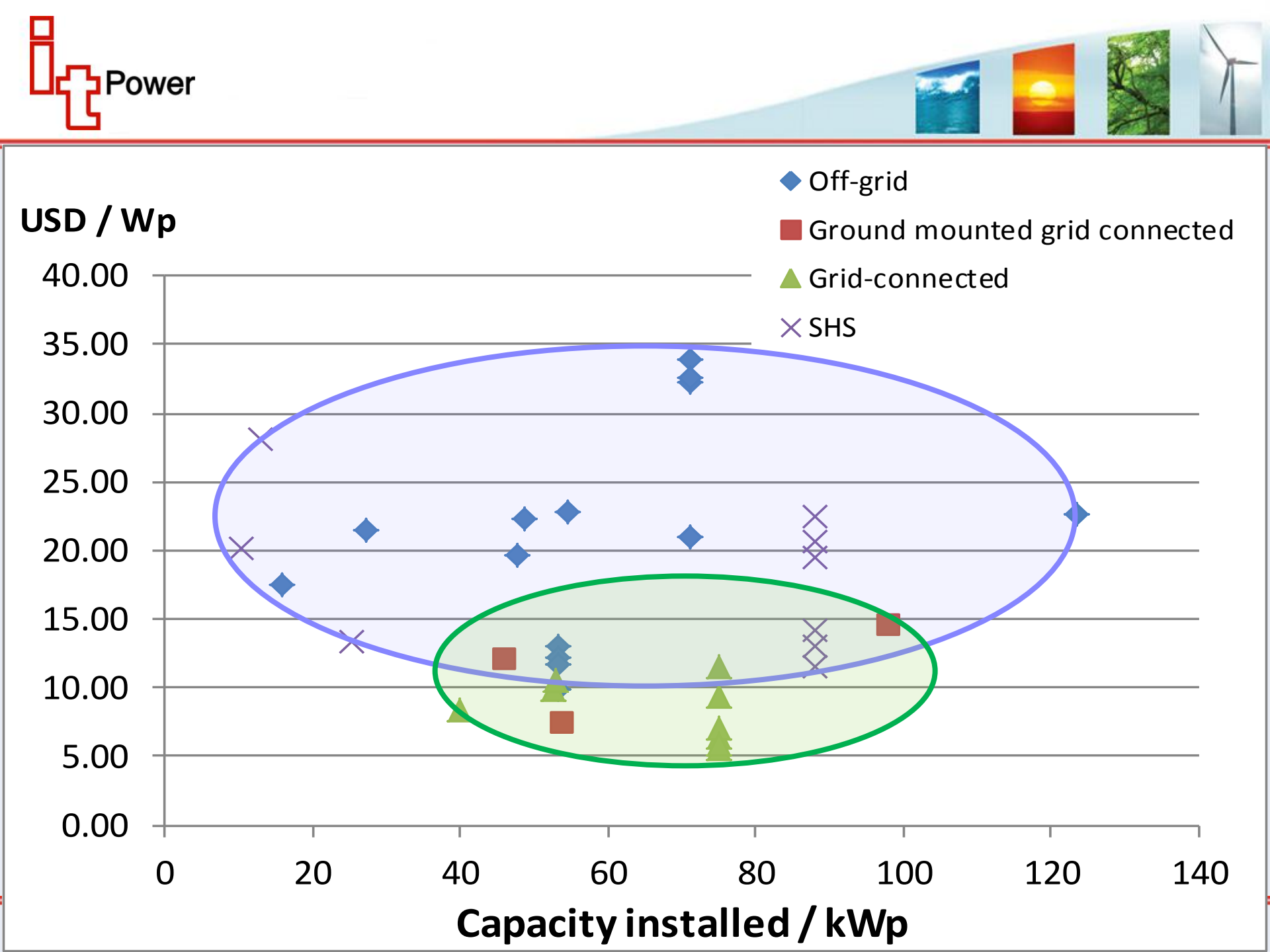
Installed cost of RE

Solar PV costs

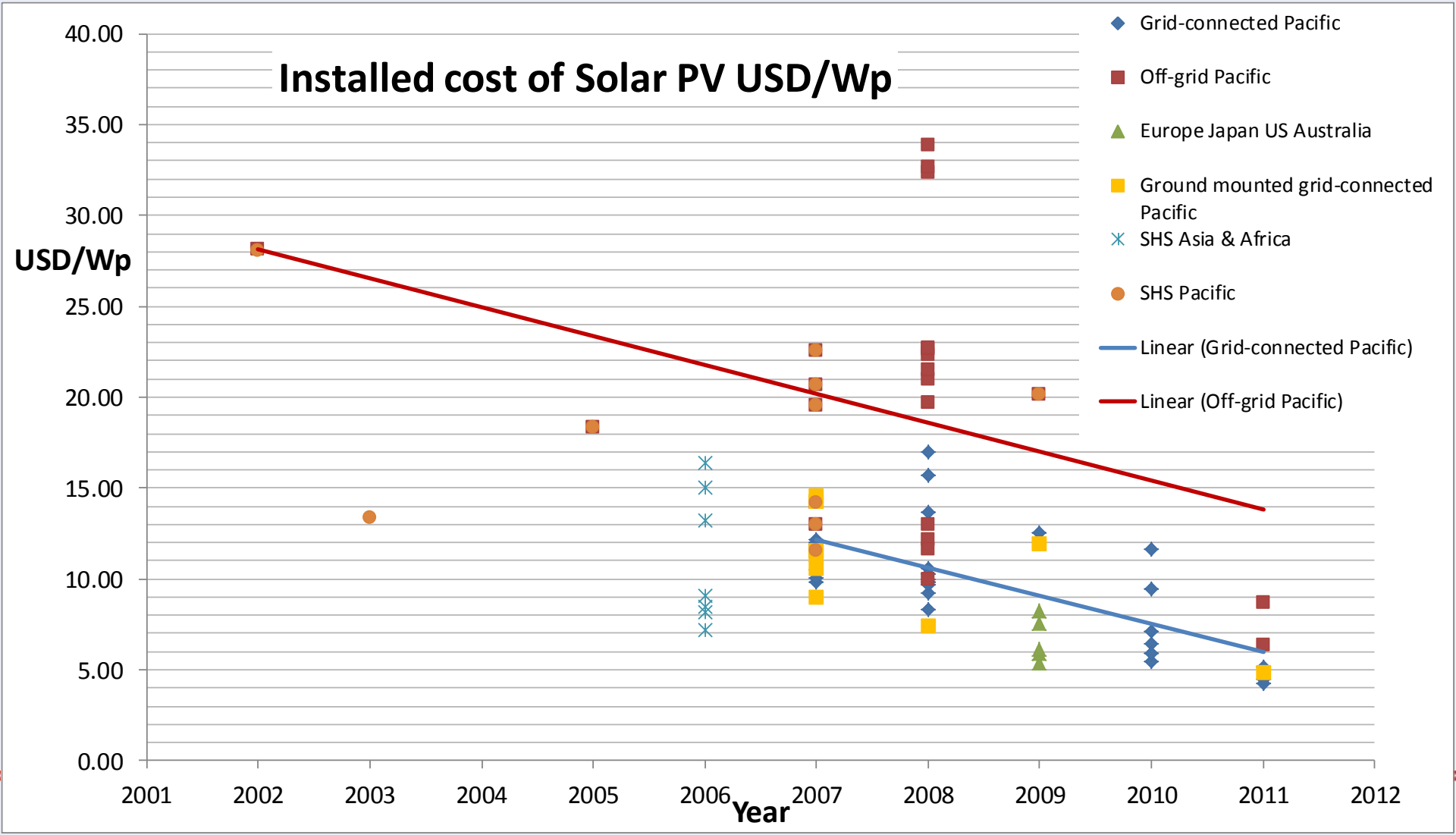
- Most common installation in the PICs
- All PICs have some experience with solar PV – most info available *but not as much as there should be*
- Four main types:
  - Solar home systems / lighting systems
  - Small off-grid systems (schools, health centres)
  - Grid-connected PV
  - Hybrids

Installed cost of solar PV

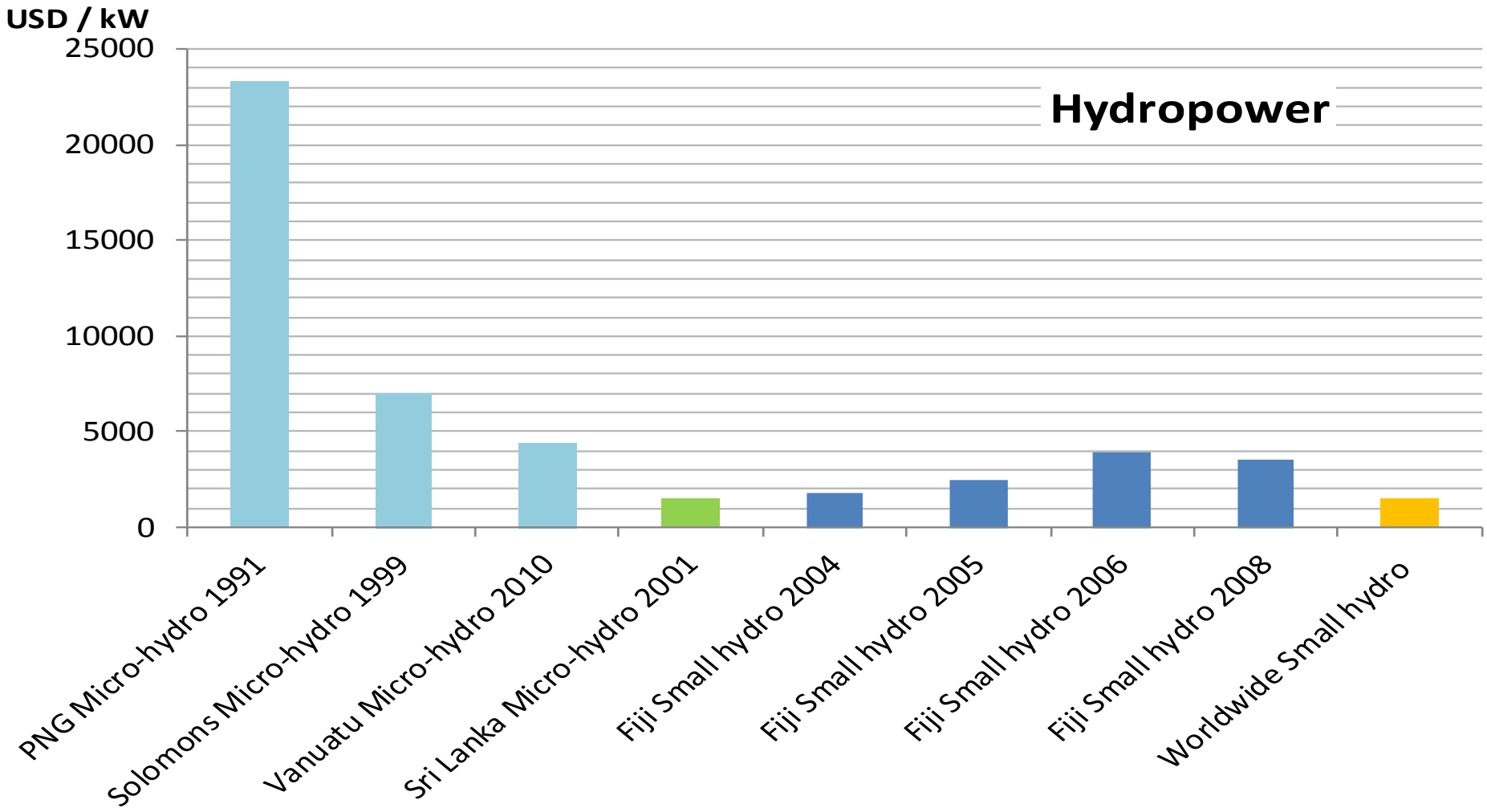



Off-grid
Ground mounted grid connected
Grid-connected
SHS
USD / Wp
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0
20
40
60
80
100
120
140
Capacity installed / kWp

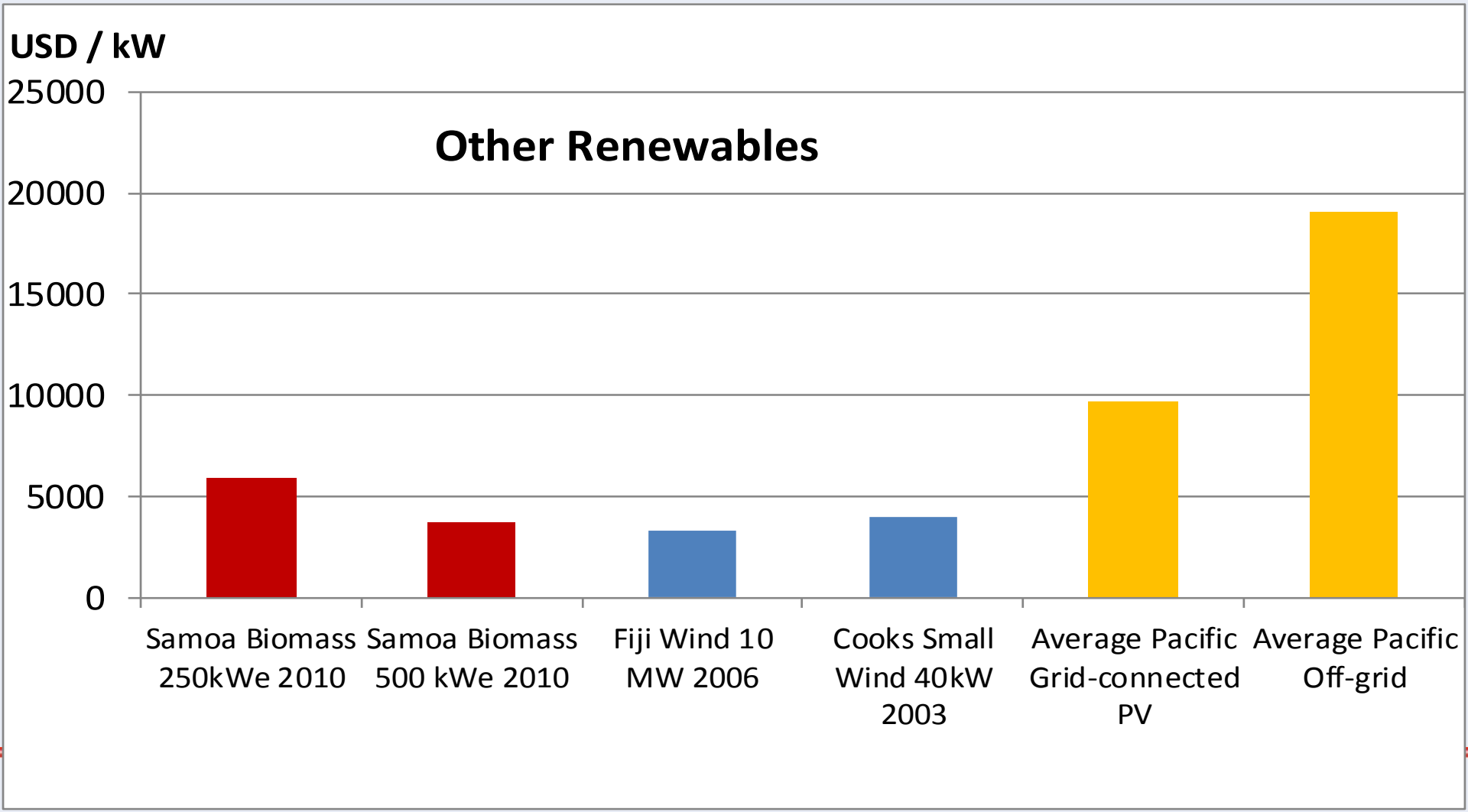
Solar PV costs over time



Installed cost of Hydro



Installed cost – other RE



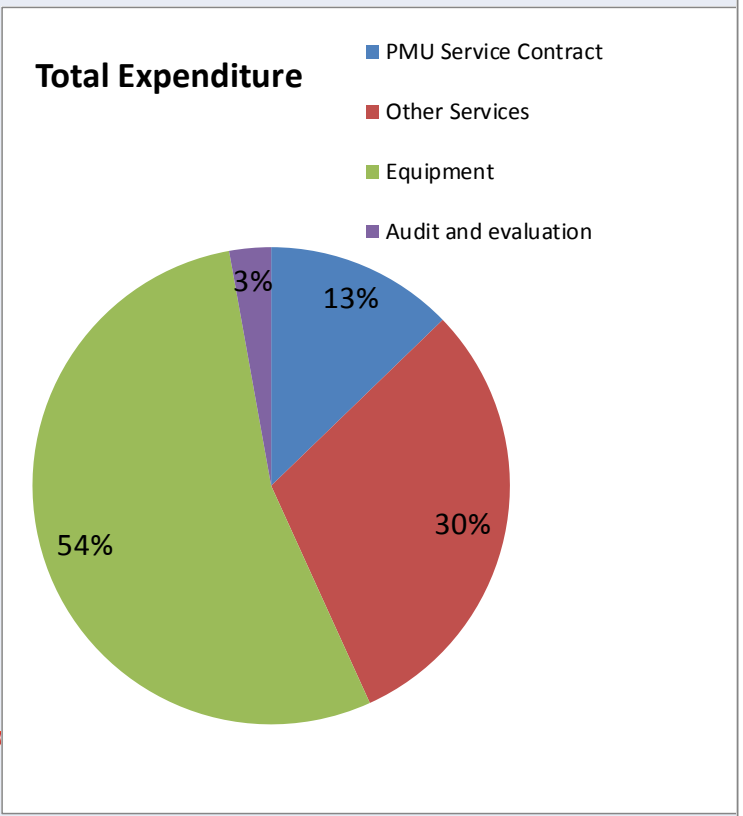
Summary of installed costs

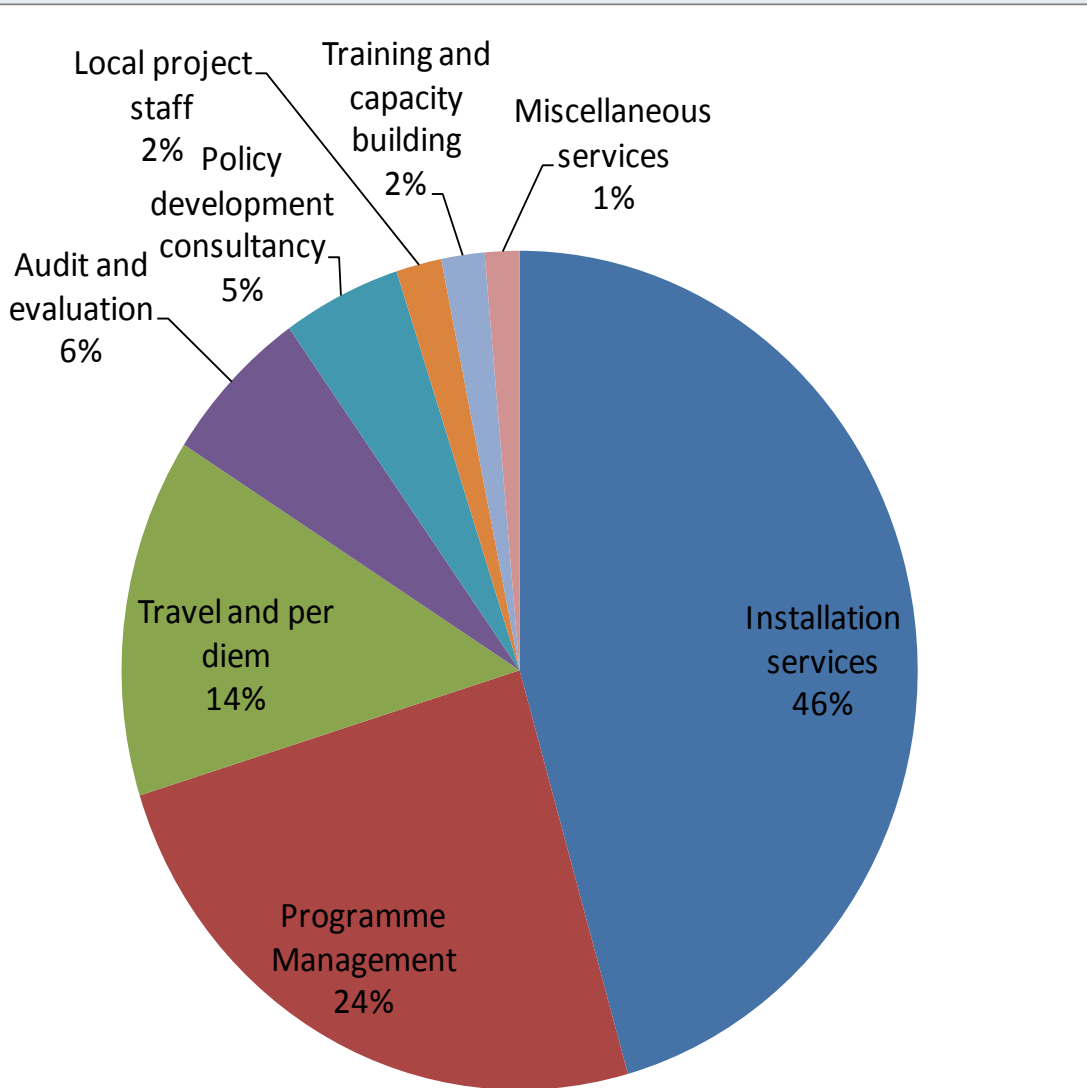
Technology	Cost range in USD / kW
Grid-connected solar PV	4500 – 14000
Off-grid solar PV	10000 – 34000
Micro-hydro	4000 – 23000
Small-hydro	1800 – 4000
Small-scale wind	4000
Large-scale wind	3300
Small-scale biomass	3500 - 6000
Diesel	800 - 1500

Breakdown of costs

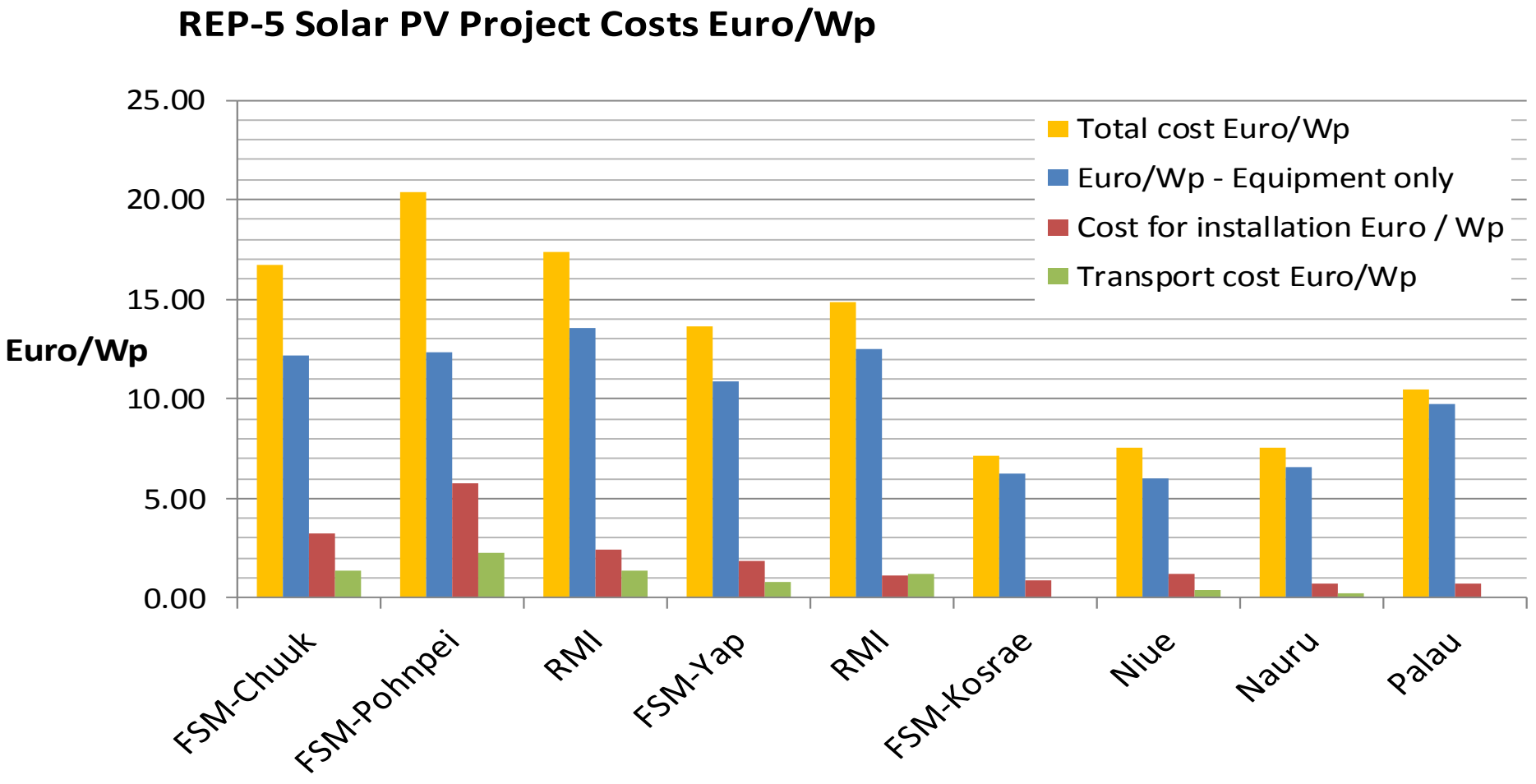
REP-5: Whole programme cost example

Total cost =
12.3 million Euro

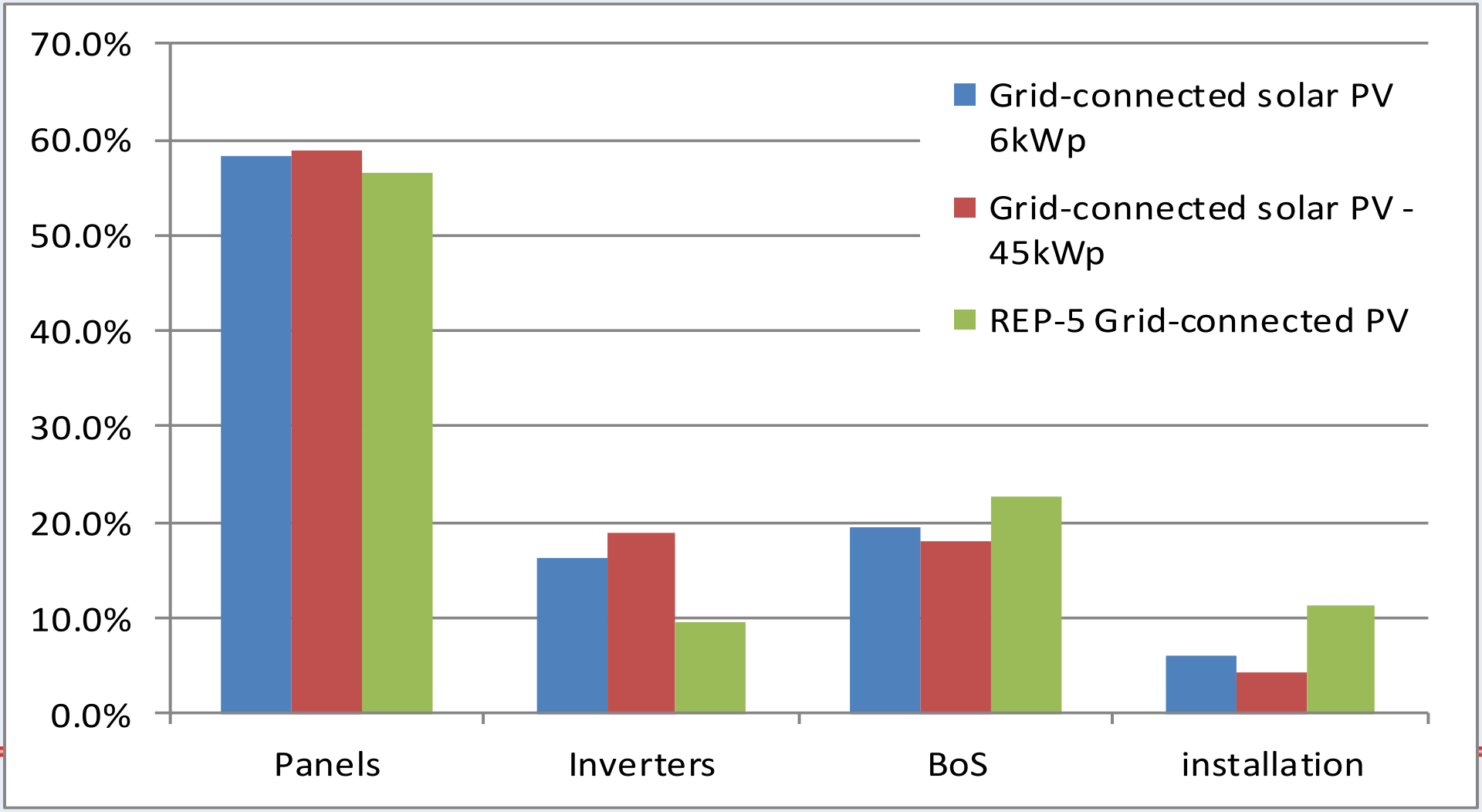




REP-5: Equipment + installation + transport cost

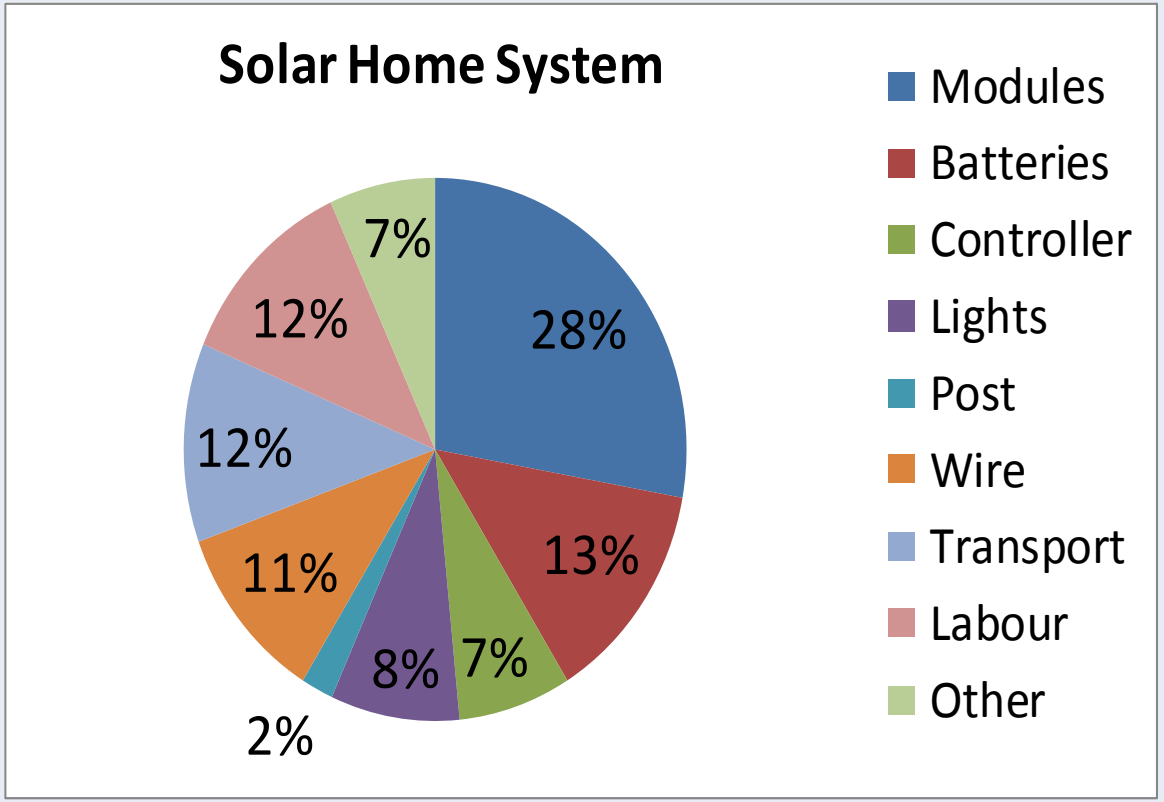


Breakdown of cost for grid-connected PV



Breakdown of cost – Solar Home System

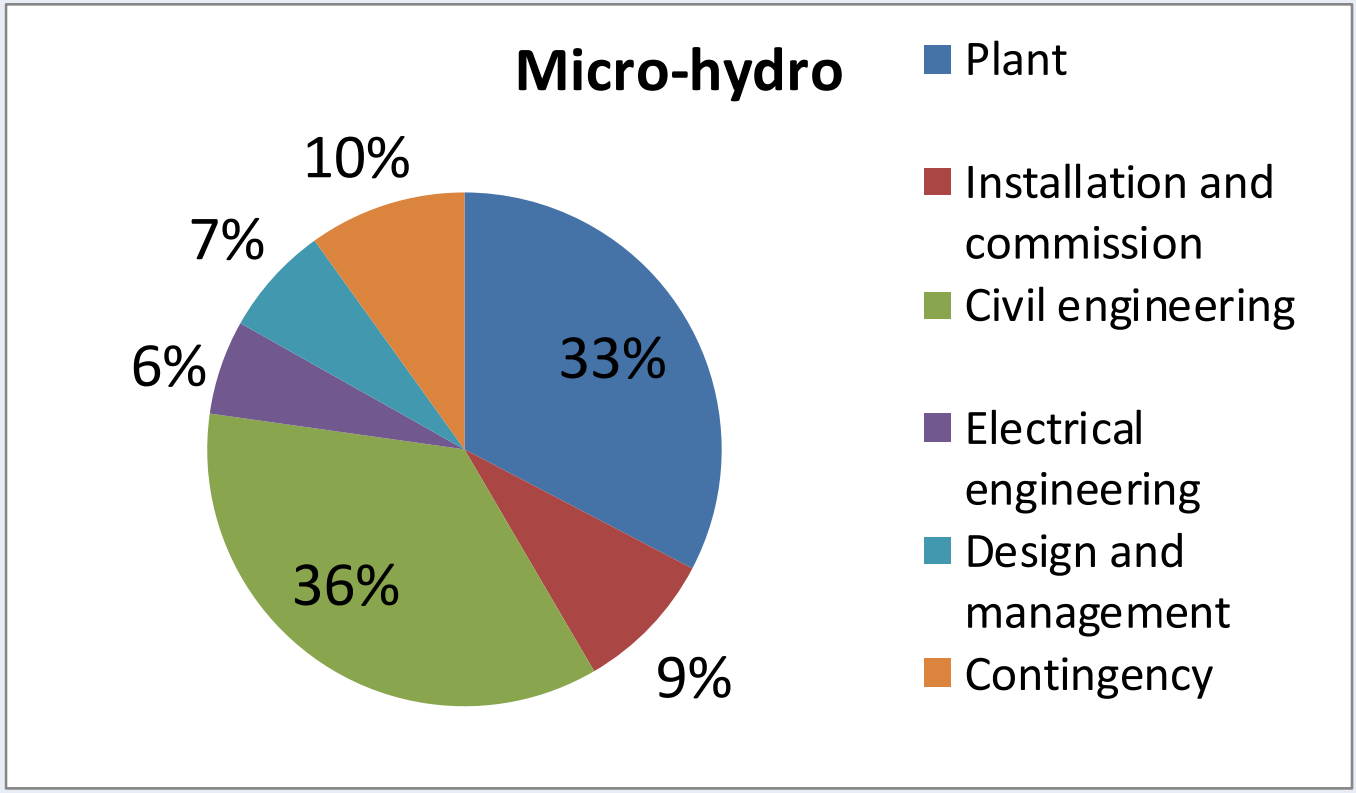
- Typical size: 100 – 200Wp
- Typical cost: 2000-3000 USD per system
- Connection fee: 100USD
- Monthly fees: 5 – 12 USD



Micro-hydro – typical costs

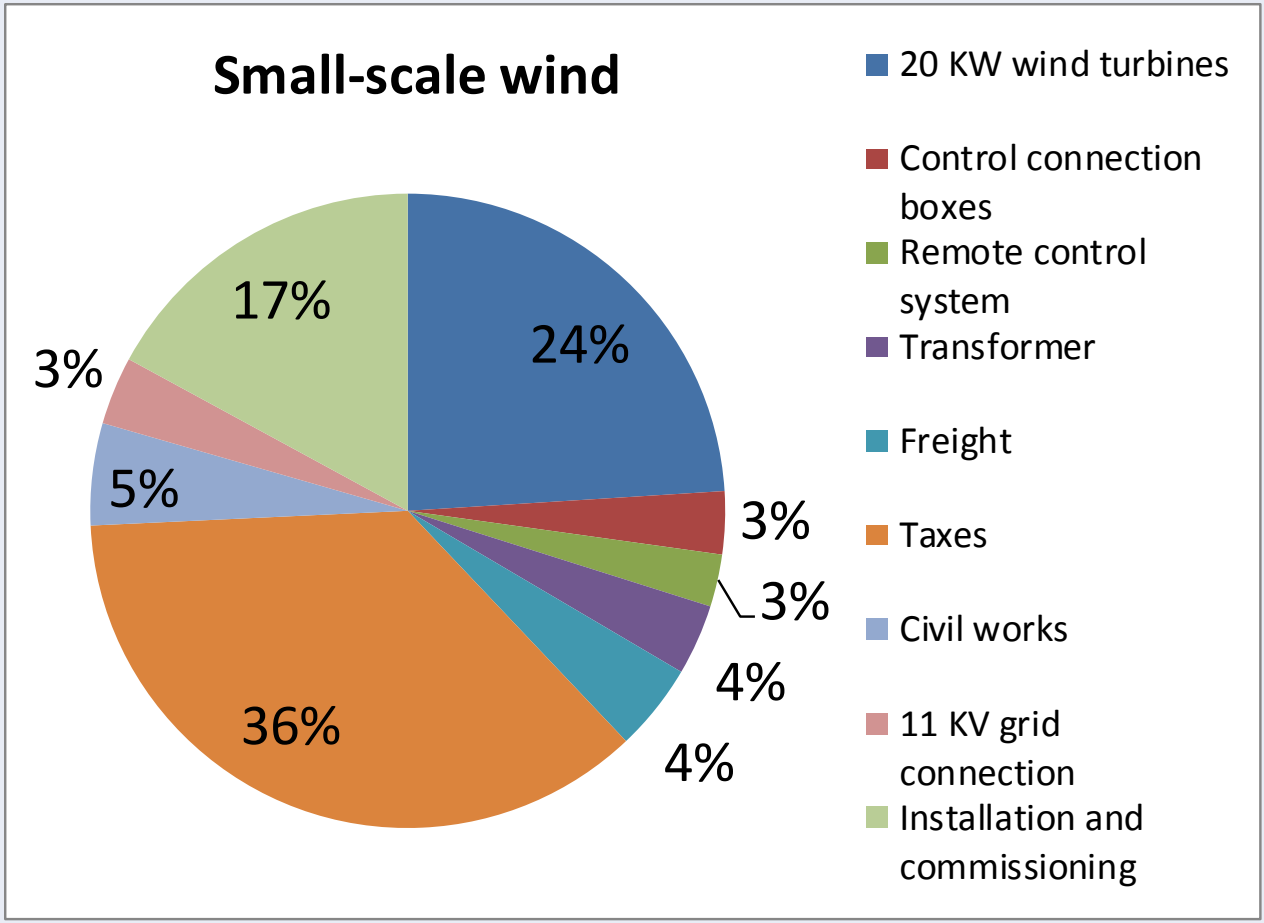
Other costs

- Land lease cost
- EIA
- Access to site



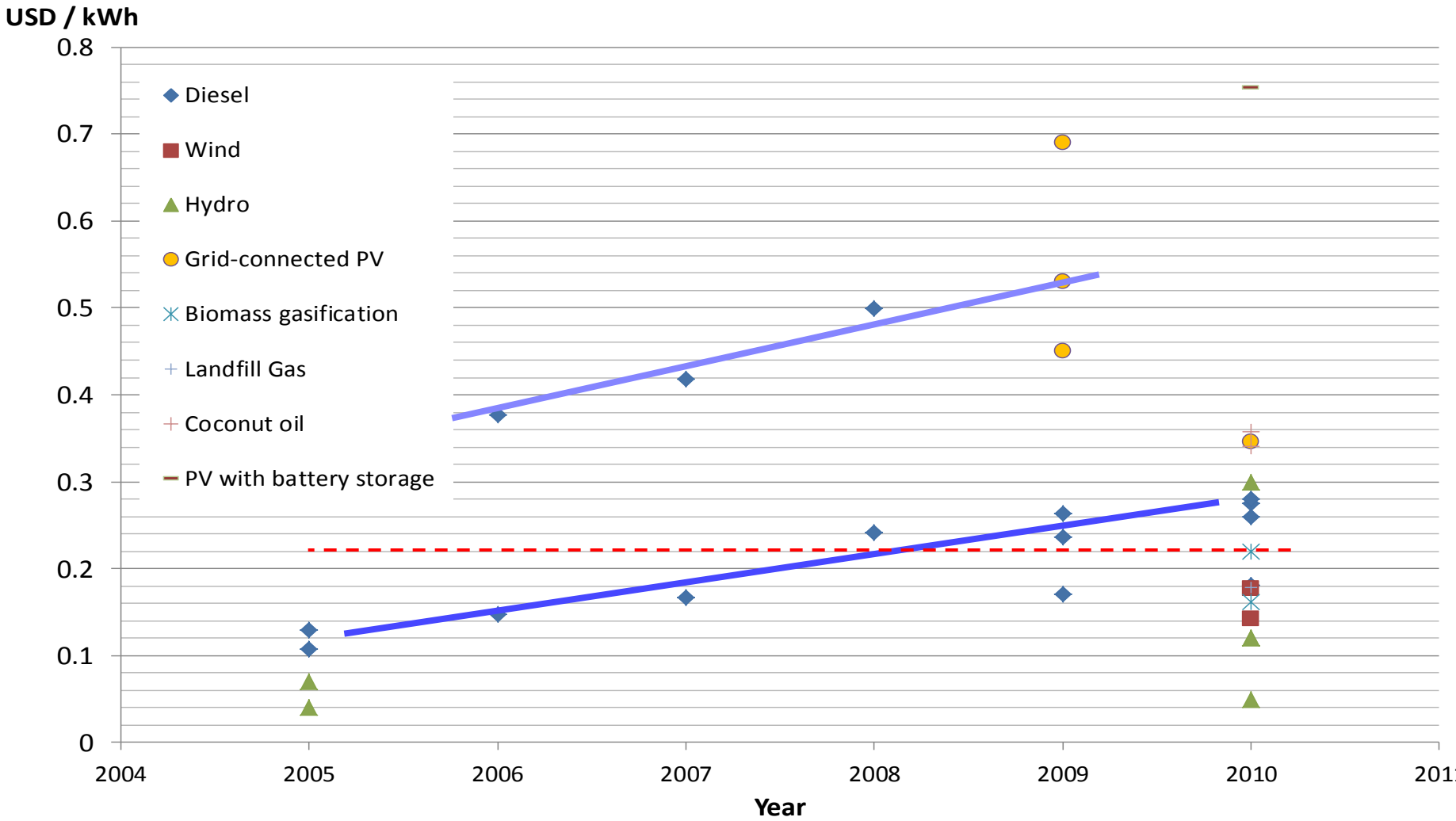
Small wind PIC example

- Very few wind systems installed in PICs
- Limited resource
- Cyclones and land issues
- Cost of transport to site vs size of turbine & tower

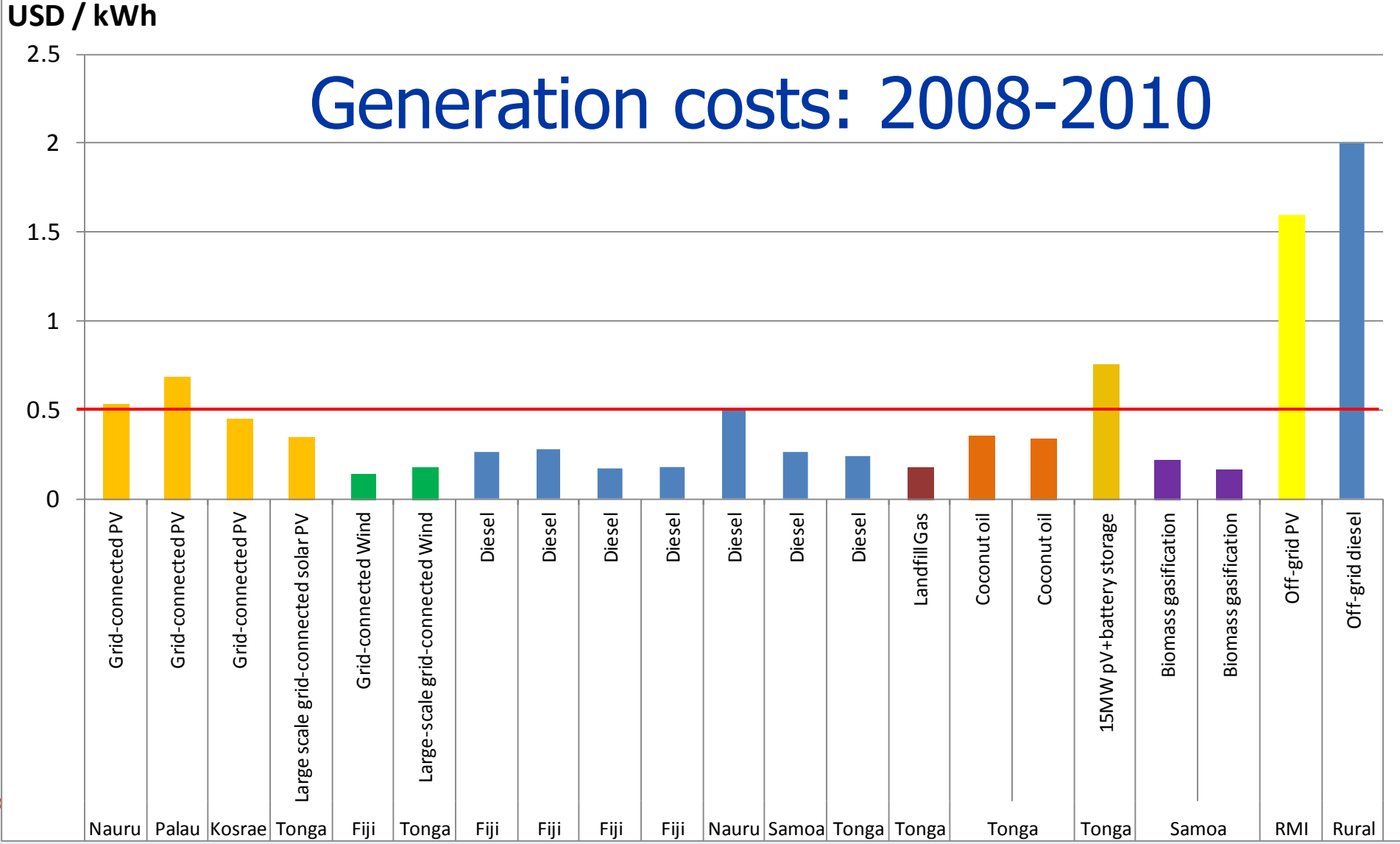


Generation costs

Generation costs



Generation costs: 2008-2010



Summary of generation costs

Technology	PICs range of cost in USD / kWh	International costs (REN21) USD / kWh
Grid-connected solar PV	0.35 – 0.70	0.17 – 0.34
Large-scale PV + battery storage	0.75	0.25 – 1.00
Off-grid solar PV	1.50 – 2.50	0.40 – 0.60
Large-scale Wind	0.14 – 0.18	0.05 – 0.09
Coconut oil	0.34 – 0.38	0.30 – 0.80 (biofuel/biodiesel)
Biomass gasification	0.16 – 0.22	0.08 – 0.12
Landfill gas	0.18	-
Urban diesel	0.15 – 0.49	-
Rural diesel	1.00 – 2.50	-

A few more comments on costs

because there's not enough time to cover everything

O&M costs

- Woefully underestimated for most RE projects in the PICs
- Not planned for
- Often do not include full replacement of failing parts during project lifespan
- Biggest area needing improvement in knowledge and data availability

Transport & Logistics

- RE face same supply chain issues as fuel
- Singapore - 90-95% of cost
- Freight Costs to Primary Port: + 4.5-9.5%
- Insurance and Loss: + 0.5-0.6%
- Transport, handling and distribution costs to ship to secondary ports: + 15-30% to total cost
- Not to mention delays and unreliable/ unpredictable shipping / flight schedules

Confirming the resource – assessment / feasibility costs

- Wind Monitoring system on Kiritimati 2009 (Line Group), USD105,000
- Wind monitoring studies 30 – 100k USD
- Hydro/biomass feasibilities 5%-10% of capital cost
- Geothermal exploration and drilling – very capital intensive

Taxes & duties on RE equipment

- Some countries have already waived taxes on renewable energy equipment
- E.g. Fiji
  - no import duties on RE equipment
  - 10 year tax holiday on biofuels
- Tax relief for RE under consideration in Tonga (2009)

Let's not compare apples with oranges

- Solar PV capacity factor = 10 – 20%
  - 14-15% in Nauru, Kosrae, Palau
- Wind = 15 – 30%
  - 7.5% in Fiji, Vanuatu?
- Hydro = 50 - 60%
  - 30% in Fiji, Samoa?
- Biomass??

Data gaps

A few ideas

Data gaps – O&M / lifecycle costs

- More emphasis on lifecycle cost and inclusion of equipment replacement costs in O&M
- Start taking into account environmental / end-of-project disposal costs
- Donor RE projects should have O&M / post-installation monitoring component

Data gaps – what can be done

- Systematic collection and publication of cost of RE projects / technologies in the PICs – as is done for fossil fuels
- More investment in post-installation monitoring technologies/ analysis / skills (capacity building)
- More contact with suppliers = better info on costs to Pacific
- Ask utilities to make data available in some format
- Ask Governments to make tender data available

Conclusions

Conclusions: Costs influenced by many other factors

- Cannot judge costs in isolation
- Cannot generalise across PICs as there is so much variability across countries
- Institutional & regulatory environment and technical capacity have a big impact
- Transactions costs are high and hard to predict

Conclusions: Economic / Financial viability

- Generalisations across PICs for the same technology should be avoided as financial viability can vary significantly depending on location – even within the same country
  - Transport and logistics
  - Labour costs
  - Competing uses of the energy resource
  - Environmental Impact
  - Population income and willingness to pay for electricity services

Economic / Financial viability

- **Recommendations:**
  - Ensure all necessary preliminary studies are carried out
  - Project and site selection should be based on the results of the appropriate studies and not forced by other external considerations
  - Different companies should be contracted for the feasibility and implementation phases
  - Environmental costs should always be factored
  - PICs must move towards full cost recovery tariffs - users must pay for O&M and government, cabinets, parliaments should not arbitrarily reduce charges

Institutional frameworks

- Lack of regulations creating an enabling environment:
  - IPPs / PPAs / Feed-in-tariffs / Net-metering
  - Non-transparent subsidies / unsustainable subsidies, particularly for outer island electrification
  - Many utilities are also the regulators
- **Recommendations:**
  - Create independent regulation of power utilities
  - Layout clear rules regarding PPAs, IPPs, feed-in tariff, access to grid, etc. to encourage private sector participation

Technical capacity

- RE technologies still relatively new to utilities / Government staff = more training and capacity building of staff in all aspects of RE technologies = more able to manage RE / negotiate projects
- Recruitment of more (qualified) staff and measures taken to retain staff who attend training
- **Recommendations:**
  - Focus first on the most viable technologies & seek independent advice
  - Insist on donor support for post-installation training
  - Establish training in technical colleges and universities to nurture the energy professionals of the future

Cross-sectoral coordination

- As energy affects all sectors of the economy efforts have to be increased to coordinate planning and projects
  - Ministries of Environment
  - Ministries of Agriculture
  - Ministries of Education
  - Ministries of Health
  - Ministries of Industry, Tourism, etc.
- Multi-lateral, bi-lateral donors, CROP agencies, NGOs and technical cooperation

Although diversification of energy supplies is a priority for PICs time should be taken to plan strategically so that the conditions are in place for new RE infrastructure to be functioning as desired for many years to come

Thank you!

Any questions?