UTILITY VALUE AND COST OF PV INSTALLATIONS

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MAJOR CONSIDERATIONS FOR VARIABLE RE INTEGRATION

- CLEAN ELECTRICITY GENERATION
- ENERGY SECURITY
- POTENTIAL SOCIAL AND ECONOMIC BENEFITS INCLUDING FUEL COST SAVINGS, AND UTILIZATION OF INDIGENIOUS RESOURCES

PROS

- HIGHLY VARIABLE OUTPUT AT SEVERAL DIFFERENT TIMESCALES: HOURLY, DAILY, AND SEASONALLY
- ASSURANCE OF RELIABILITY AND PROVISION RESULT IN ADDITIONAL COSTS TO UTILITTIES

CONS

POWER SYSTEM RELIABILITY EVALUATION

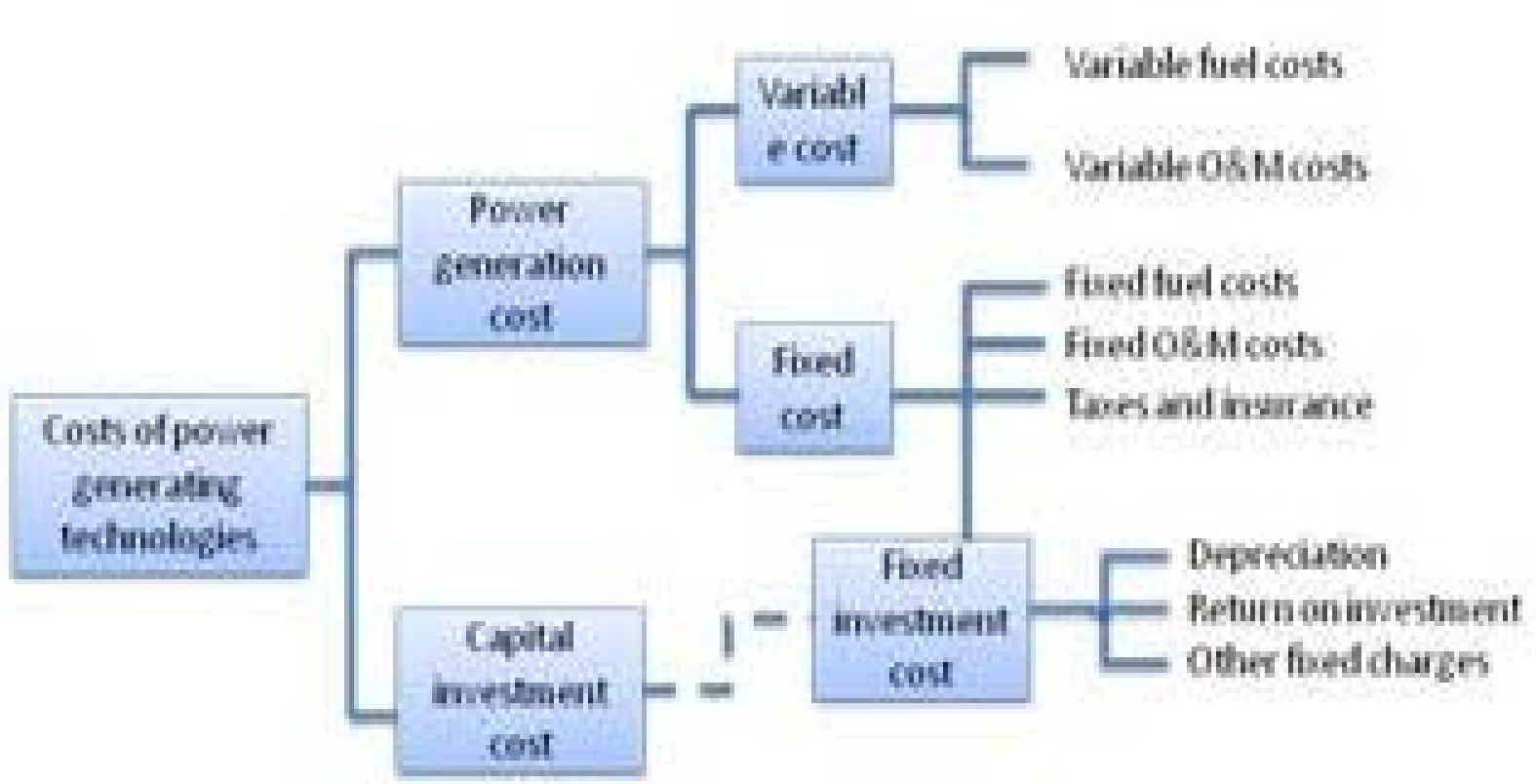
- The reliability in power system – providing customers with a reasonable assurance of quality and continuity of service
- This assurance and continuity are dictated by customer needs and has related costs of provision

- A system is with higher reliability level will result in a greater financial investment.

POWER SYSTEM RELIABILITY EVALUATION

- Reliability evaluation of power systems includes a) evaluation of the reliability of the energy generation part; b) energy transmission and c) distribution networks $\Leftrightarrow$ hierarchical levels
- Level I – total system generation to determine adequacy for total system load;
- Level II – generation + transmission – integrated ability of the composite system to deliver energy to the bulk supply points
- Level III – generation + transmission + distribution

POWER GENERATION COSTS – OPTIMAL UTILITY COST METHOD (OUCM)

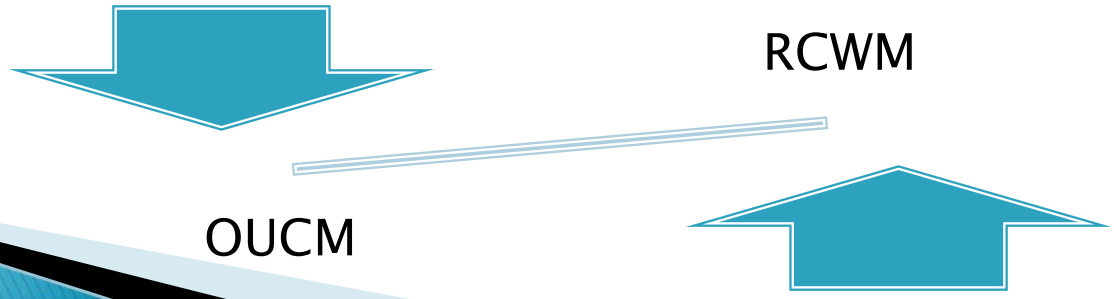


COST EVALUATION OF POWER SYSTEMS (OUCM)

- Fuel and O&M – both have fixed and variable cost components;
- Fixed charges  function of capital investment;
- OUCM neglects outage probabilities of system components;
- However – reliability lacks existence;
- The “value/worth” of reliability lies in the price customers will pay ⇔ customer interruption costs created by power failures

COST EVALUATION OF POWER SYSTEMS

- RELIABILITY COST/WORTH METHOD (RCWM) accounts for both utility and customer interruption costs
- RCWM has an objective function - outage cost (reliability worth) derived from Loss of Energy Expected (LOEE) and Loss of Expected Energy Not Served (EENS). OUCM includes only Loss of Load Expected (LOLE)



COMPARISON BETWEEN OUCM AND RCWM

	Model 1	Model 2
Objective function	Minimize J = Investment cost + Operating cost	Minimize J = Investment cost + Operating cost + Outage cost
Main constraint	Reliability criterion (*LOLE*)	-
Method for assessing outage cost	-	*LOEE Customer interruption cost*

COST OF SERVICE ASSESSMENT

- **Loss of Load Expected**: expected time duration when the load exceeds the available capacity. This indicator is a criterion for comparing different system costs based on a suitable service cost model
- **Loss Energy Expected**: expected energy not supplied by the generating system. This indicator is used in conjunction with customer cost functions to obtain a factor relating customer losses to the worth of electric service reliability

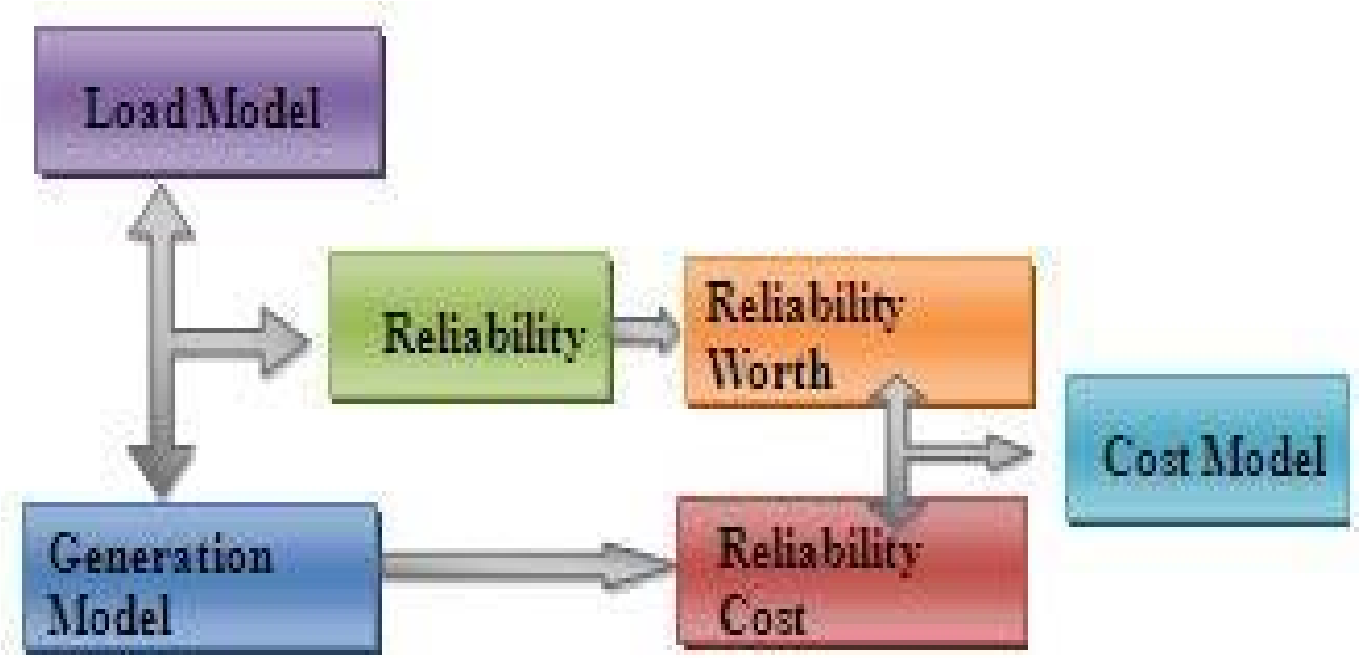
RELIABILITY CRITERIA FOR SOME ELECTRIC COMPANIES

Country (company)	LOLE(d) (d/a)	LOLE(h) (h/a)	Country (company)	LOLE(d) (d/a)	LOLE(h) (h/a)
Australia		5~7	Japan	0.3	
Belgium		16	Jordan	0.4	
Brazil	2.5		Sweden	0.4	
Canada	0.1	2.5	U.S.A.	0.1	
CIS		35	Norway		3
U.K.	1.8		Spain	0.1	
Finland		9	Romania	0.1~1.2	
France	0.2	2	Slovenia		20
Ireland	1.5	9	South Africa	6	20

COMBINED RELIABILITY AND ECONOMIC ASSESSMENT

- Three models should be built:
- 1) load model;
- 2) generation model; and
- 3) service cost model
- The first two models can calculate LOLE and LOEE.
- Then the service cost model can be built showing both reliability cost and worth

COMBINED RELIABILITY AND ECONOMIC ASSESSMENT



CONCLUSION

- Traditional Optimal Utility Cost Methods are not reflective of the customer value (worth) of reliability
- Utility costs needs to reflect cost of service of interruptible power supply
- Electricity price from independent power producers of RE generation need to be rated to compensate/share utility service cost

QUESTIONS?
Thanks!

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