



Interconnection

Wind Working Group
April 8, 2002



Hawaiian Electric Company, Inc.

WHAT ARE INTERCONNECTION STANDARDS?

Interconnection standards are specific technical requirements for paralleling distributed generation (DG) with the utility system.

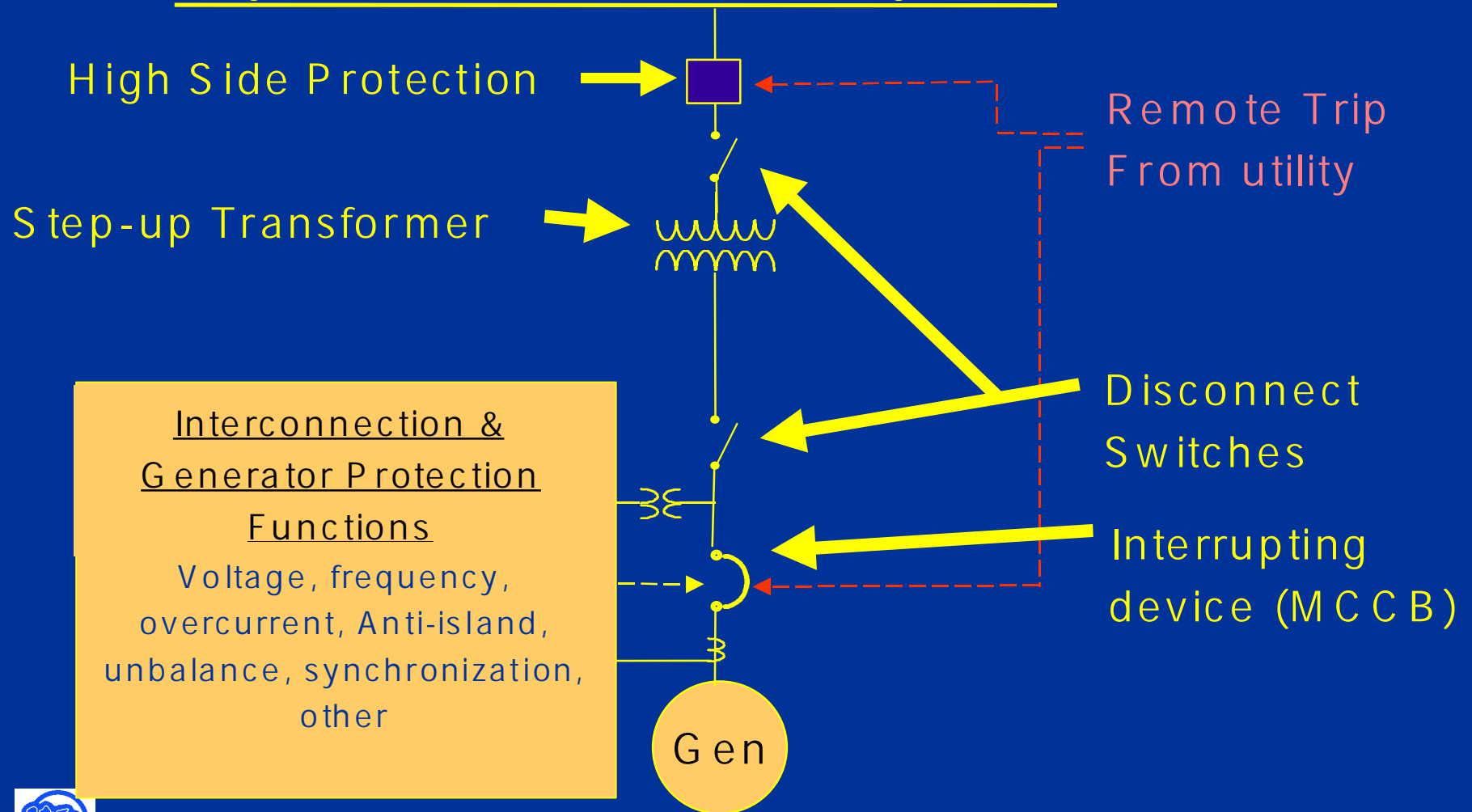


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Components of DG Interconnection

Utility Distribution Feeder Primary



WHY DO WE NEED INTERCONNECTION STANDARDS?

- Interconnection standards are necessary to ensure safety, reliability, and power quality.
- Afford consistent application of requirements.
- Help streamline review and approval processes.
- Allow higher levels of DG penetration.



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Power System Impacts of DG

- Voltage Regulation
- Power Quality
- Reliability
- Operational Safety
- System Loading
- System Efficiency



Diesel Generators

DG can help in all of the above areas – or it can worsen performance in all the above areas!



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HECO's Standards

- **Based on national standards and guidelines**
- **Incorporates features to account for our unique island systems**
- **Filed with the PUC in January 2002**



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What Are Addressed By The Interconnection Standards?

- **General Interconnection Guidelines**
- **Design Requirements**
- **Operating Requirements**
- **Protection, Synchronizing, and Control Requirements**



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Sample of Interconnection Standards

- Isolation Device - A disconnecting device with a visible break that is accessible and lockable in the open position by authorized utility personnel
- Anti-Islanding Provisions
- Interrupting Device – A circuit breaker or interrupting device capable of interrupting the maximum available fault current at the site
- Protective relaying and coordination of settings



Disconnect Device



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Performance Standards for Wind Farms

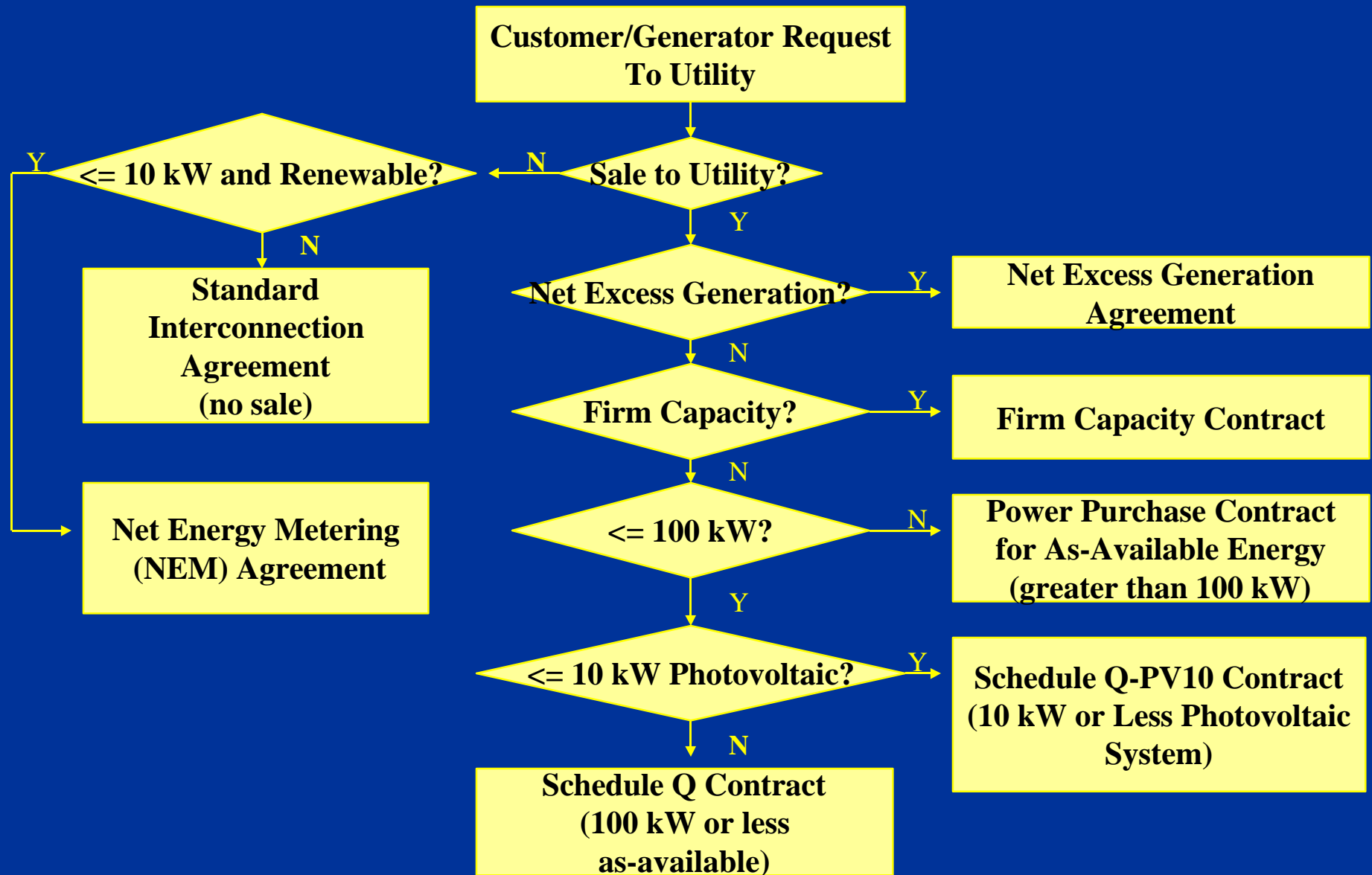
- Ramp rate
- Power fluctuation rate
- Voltage flicker
- Harmonics



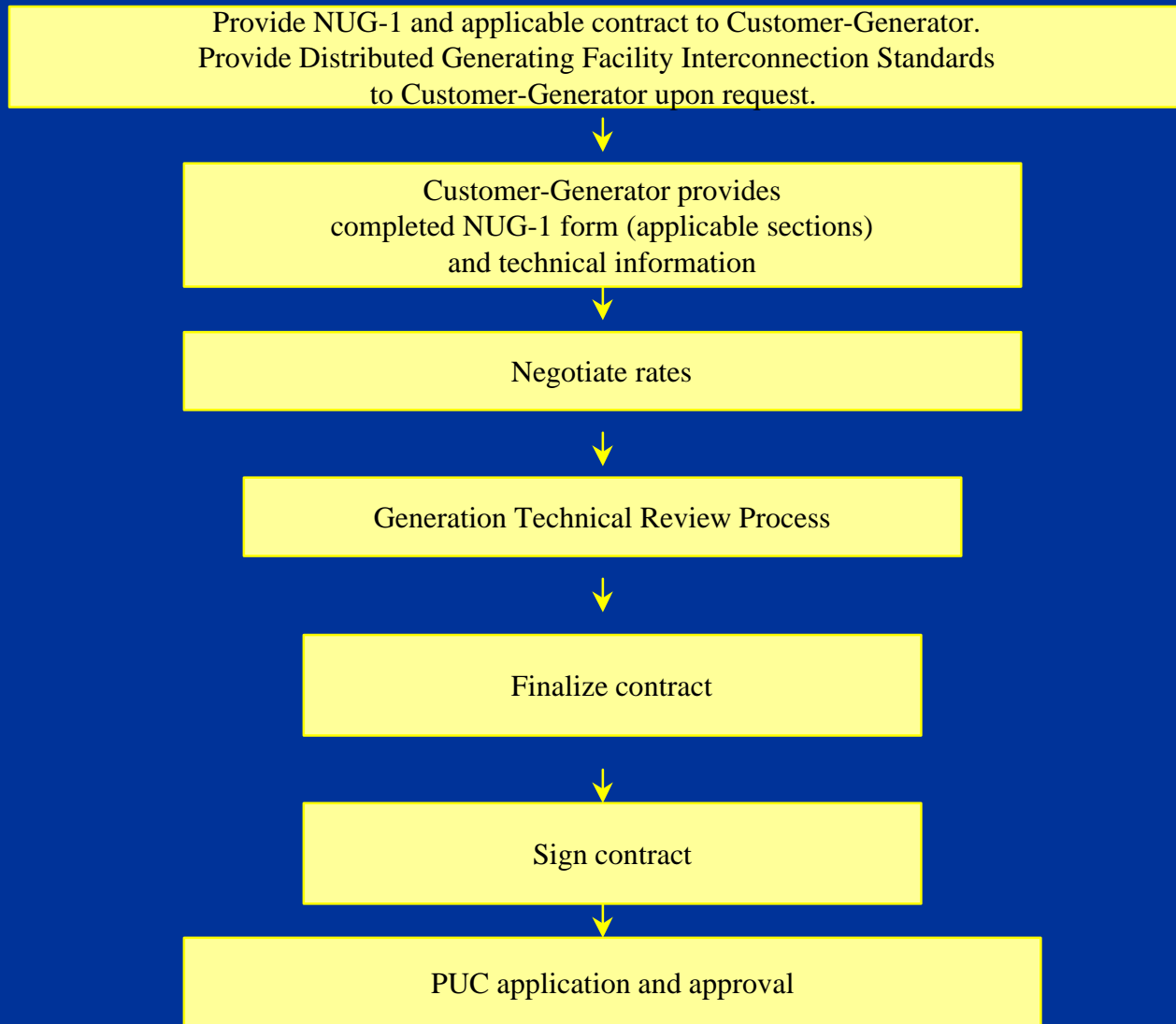
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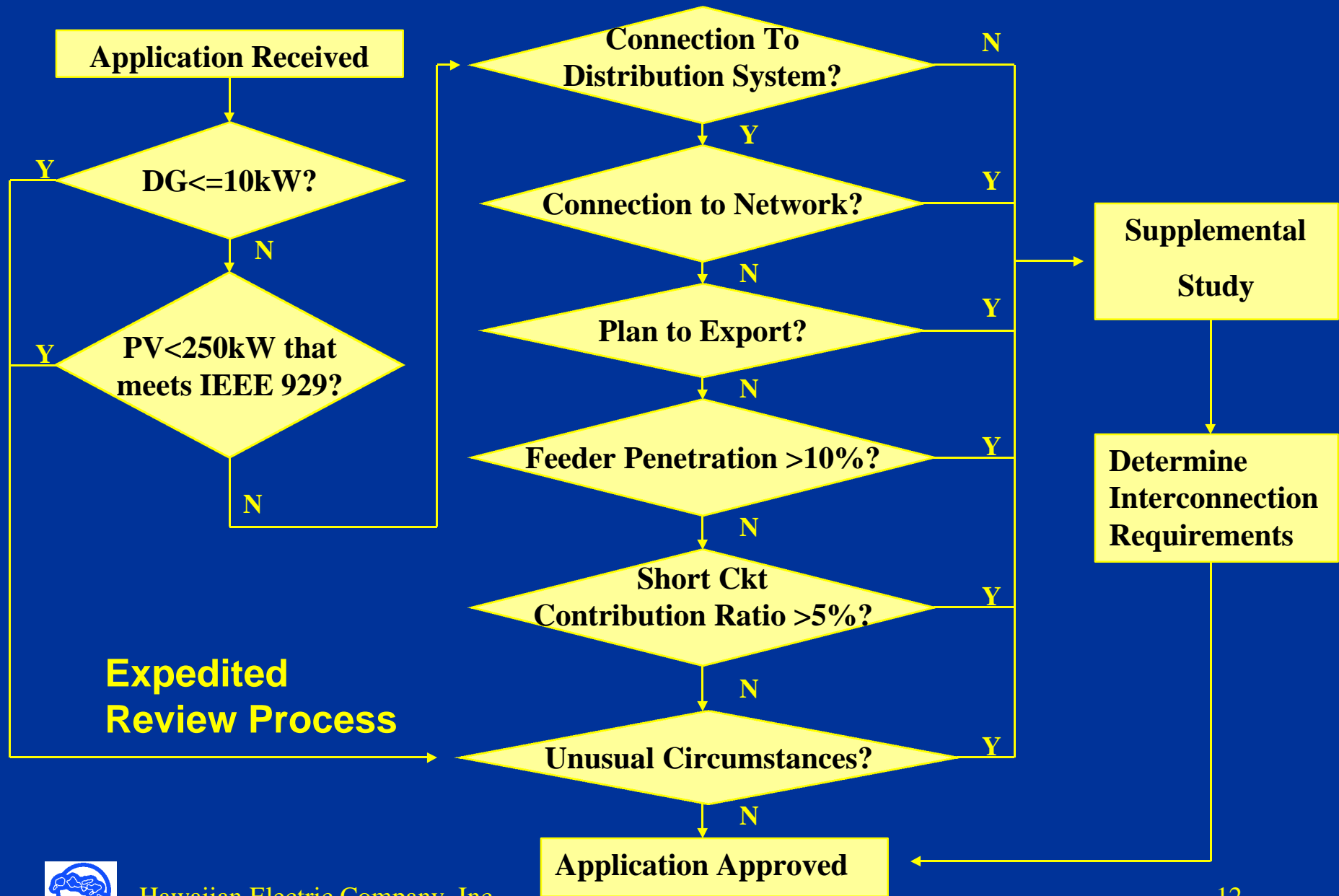
Process for Interconnecting Generators



Typical Contract Process



Generation Technical Review Process



Supplemental Study Considerations

- Location, size, and type of DG
- Distribution circuit voltage and load
- Protection devices on circuit
- Voltage regulation equipment on circuit
- Transformer connection type
- Fault current contribution of DG
- Aggregate DG penetration on circuit
- Export of power



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Typical Contract Provisions

- Customer-generator and facility information
- Interconnection equipment requirements
- System protection and operating requirements
- Personnel and system safety
- Permits, approvals, and licenses
- Pricing
- Term of agreement
- Other terms and conditions



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SUMMARY

- **Interconnection standards detail the specific technical requirements for interconnecting DG with the utility system**
- **Inappropriate interconnection can harm people and equipment, and reduce reliability and power quality**
- **HECO's interconnection standards follow national guidelines and codes**



Damaged Equipment



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SUMMARY

- **Following Standards may help increase allowable penetration levels for DG on utility systems.**
- **Talk to your utility before purchasing or installing equipment.**
- **They will help you through the interconnection process, which includes a technical review and execution of an appropriate contract.**



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