Datacenter Certification
The Gap between Theory and Implementation

Quality Procedures in Data Center Project
COMMISSIONING & CERTIFICATION

המצגת הוצגה ע"י שמעון כץ
במסגרת תפקידו כמהנדס ראשי בחברת אלקטרה M&E
במסגרת כנס Electricity 2015

Commissioning

- Common practice:
  - Pharmaceutical industry
  - Chemical industry
  - IC industry
  - Owners
  - Regulatory tests: Integration safety tests

Definition

Commissioning

is the process of assuring that all systems and components of a building plant are designed, installed, tested, operated, and maintained according to the operational requirements of the owner or final client.

Commissioning (according to the Uptime Institute)

Commissioning

- A process designed to test both individual components and whole systems to ensure that they operate as the designer intended
- Commissioning (Cx) is the 'official' beginning of the facility hand off from the Contractor and Designer to Maintenance and Operations
- A commissioning agent (CxA) is generally appointed to lead the team through the commissioning process

Commissioning (according to the Uptime Institute)

CxA

- The CxA should be hired during the design phase to begin coordinating and planning the commissioning process
- Most effective when the CxA is an unbiased, third party who works directly for the owner
- Responsible for the following
  - > Directing the planning of all phases of commissioning
  - > Scripting all tests for the Integrated Systems Testing (IST)
  - > Gathering documentation from all sources and compiling into a final commissioning report

Uptime Institute

Project Characteristics

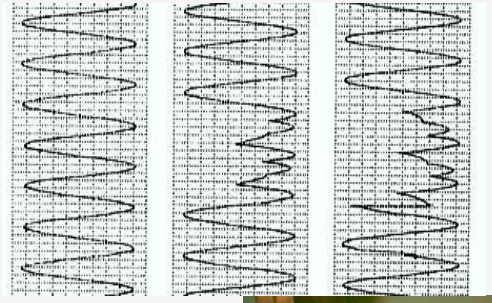
- Integration between technology, building and electromechanical infrastructures
- High availability – Tier III (or IV)
- High physical protection (unique for Israel)
- Challenging schedule
- After delivery – zero tolerance for failures
- Datacenter – necessary condition for business operation
- Energy efficiency
- Sole responsibility of contractor

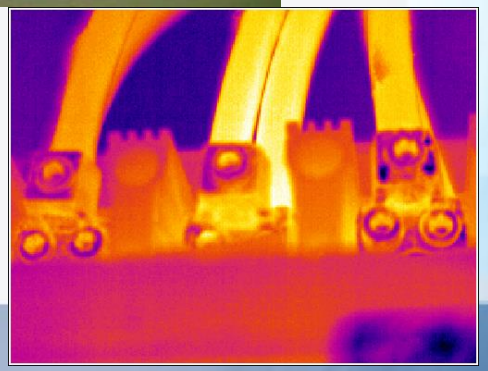
Project Quality Procedures

- Quality design
- Construction:
  - Design reviews
  - Supervision, QC, QA
  - Commissioning
  - LEED
- Uptime Institute's Certification
- Internal Audits
- Risk management audits

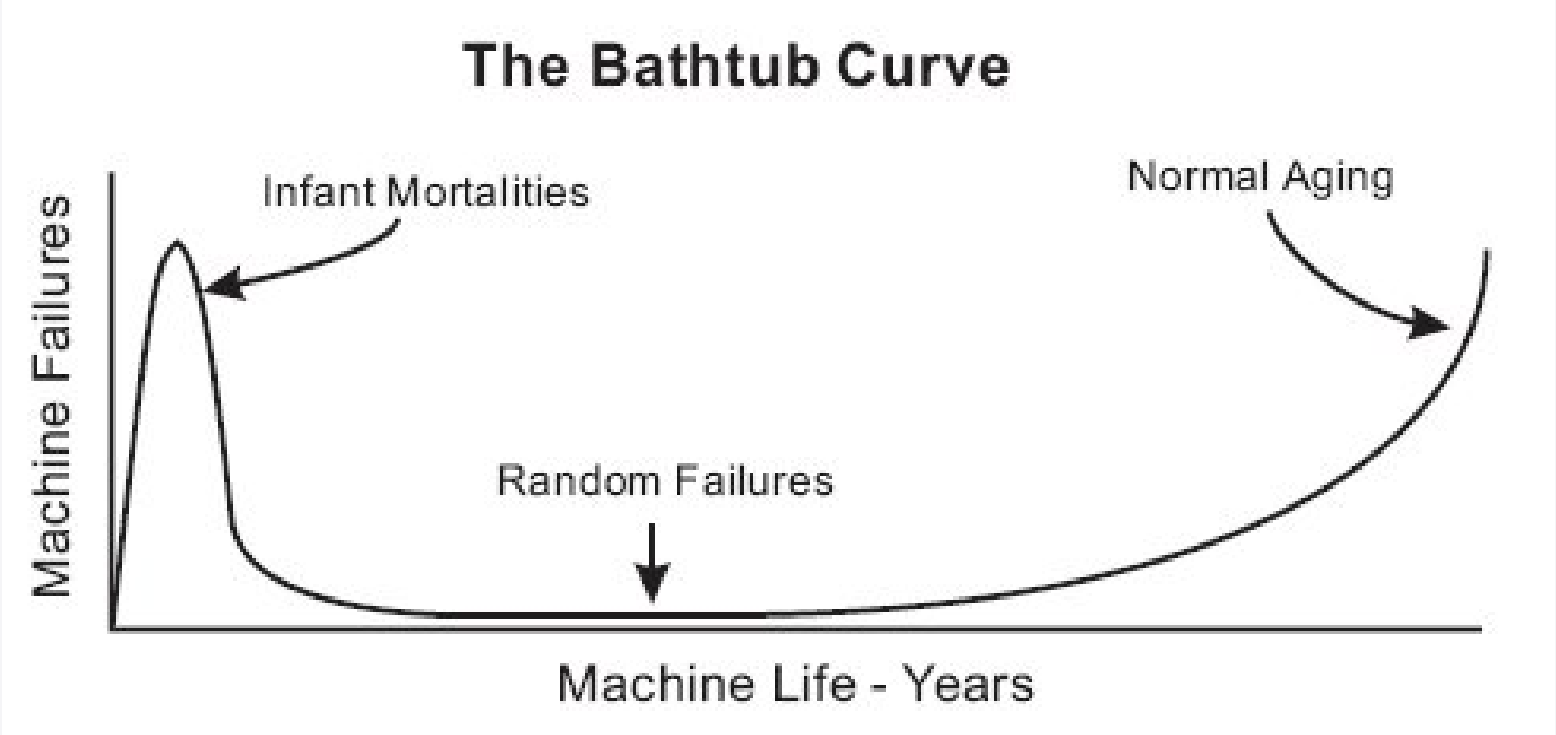
Need for Commissioning & Certification

- Design phase
- Gap analysis
- Quality of construction:
  - Shortcuts
  - Improper, missing works
  - Integration between sub-systems
  - Components failures
  - Components compliance to specification
  - SPOFs
- Training and preparation for maintenance



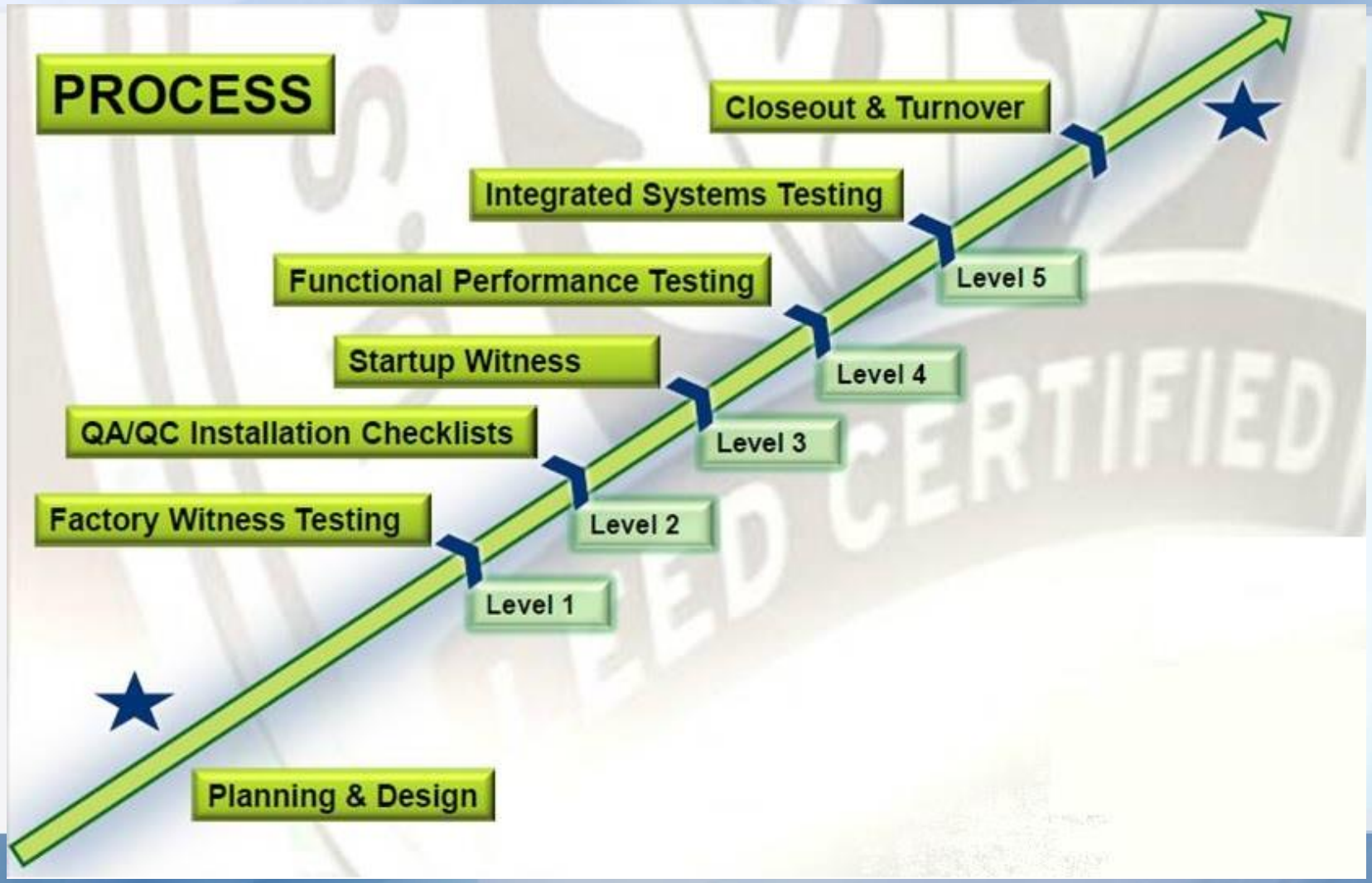


Bathtub curve



Commissioning must surpass the infant mortality period

Commissioning Phases



Commissioning – a multi level procedure

- Design phase
- Construction phase:
  - FWT
  - Installation
  - Startups
  - Functional performance
  - IST
- Operations phase
  - Documentation and training
  - Seasonal test
  - Project closure

Commissioning Stakeholder

- Owner
- Cx Agent
- Design team (architects, electrical, HVAC, BMS, Security)
- GC
- Sub contractors
- Equipment manufacturers & suppliers
- Maintenance team / contractor
- Operations
- Uptime Institute

The involvement of contractors, Equipment manufacturers & suppliers must be specified as part of their contracts

Design Phase

- Design of commissioning
- Compliance between BOD (Spec.) and design
- Testability
- Commissioning plan:
  - Phases and activities
  - Responsibilities
- Attachments for tender documentation
- Review of design documentation and drawings
- In parallel to UTI Tier Certification of Design Documents

Level 1 – Factory witness testing

- Review of FWT plans.
- Attending FWT (partial).
- Verification of compliance to manufacturers Spec.
- Verification of compliance to design demands.
- Verification of factory test reports.

Level 2 – QA/QC Installation Checklists

- Few site visits
- Review of submittals, RFIs and Change requests
- Mapping of installed Equipment
- Preparation for higher commissioning levels:
  - L3 forms – by contractors
  - L4 forms – by Cx agents
  - Schedule coordination

Level 3 – Startup Witness

- L3 forms – prerequisite for startup
- Startups by manufacturer or local representative / supplier
- Startup is generally a condition for warranty
- Baseline measurements
- Coordination between tests
  - Electrical connection before operation of HVAC.
  - Pump before chiller.
  - Cooling before UPS.

Level 4 – Functional performance Testing

- Verification of planned testing of each system – separately
- Operation of each system in every operation mode
- Simulation of various conditions, load levels and extreme situations
- Testing is performed by contractor, witnessed by Cx agent
- Attendance of operation and maintenance teams is highly recommended – a unique opportunity to “play” with the facility and try operation modes
- L4 is combined with regulatory tests (SII, 102, certified electrician Etc.)

Level 5 – Integrated System Test

- Integrative and simultaneous test of the whole facility, fully loaded as a system.
- In case of TIER certification – demonstrating the UTI test list
- Operation of each system in every operation mode
- Simulation of various conditions, load levels and extreme situations
- Simulation of failures
- Simulation of operation while performing maintenance.
- Testing is performed by contractor, witnessed by Cx agent
- Attendance of operation and maintenance teams is highly recommended – demonstrations can be performed by operation and maintenance teem.
- Verification of training & documentation
- Verification of signs and operation instructions

Tested Systems

- Data center environment
- Critical systems environment (UPS rooms…)
- Electrical system
- Cooling system
- BMS system
- Security system (firefighters control panel, EPO)

TIER Certification

- Performed ONLY by the Uptime Institute
- A long and complex procedure
- Strict compliance to the UTI standard
- No partial tier certification – for a site, for all system
- No combined tier certification – no Tier III+ or almost TIER IV
- Phase 1 - Progress Review
- Phase 2 - Tier Certification of Design Documents
- Receiving Tier Certification Demonstration List – baseline for IST
- Phase 3 - Tier Certification of Constructed Facility
- Optional - Preliminary Operational Sustainability Review & Tier Certification of Operational Sustainability

Commissioning – practical view

- GC – SPOC - responsible for building and all systems.
- Baseline for operations and ,maintenance.
- Unique opportunity for “playing” with the systems
- Time consuming procedures – 2 months at the end of the project
- Different from normal acceptance tests
- Costly – quality procedures 5% of project
- Data centers – due to over spec - the only time the site will run fully loaded. Might cause operational difficulties later.
- Lack of local Cx knowledge in Israel, partial Cx procedures.
- A certified discipline learned in universities include certification as Qualified Commissioning Process Provider (QCxP / QCP)
- Language gaps: design in Hebrew Vs. Cx in English

TIER Certification – practical view

- Most of the demonstrations – supply from generators
- All the demonstrations – fully loaded facility
- Heat loads – can be simple and manually transferred between A and B supplies
- BMS – in addition for functionality ease of logging and measurements
- Unique names, signs and marking
- Safety systems – firefighters control panel

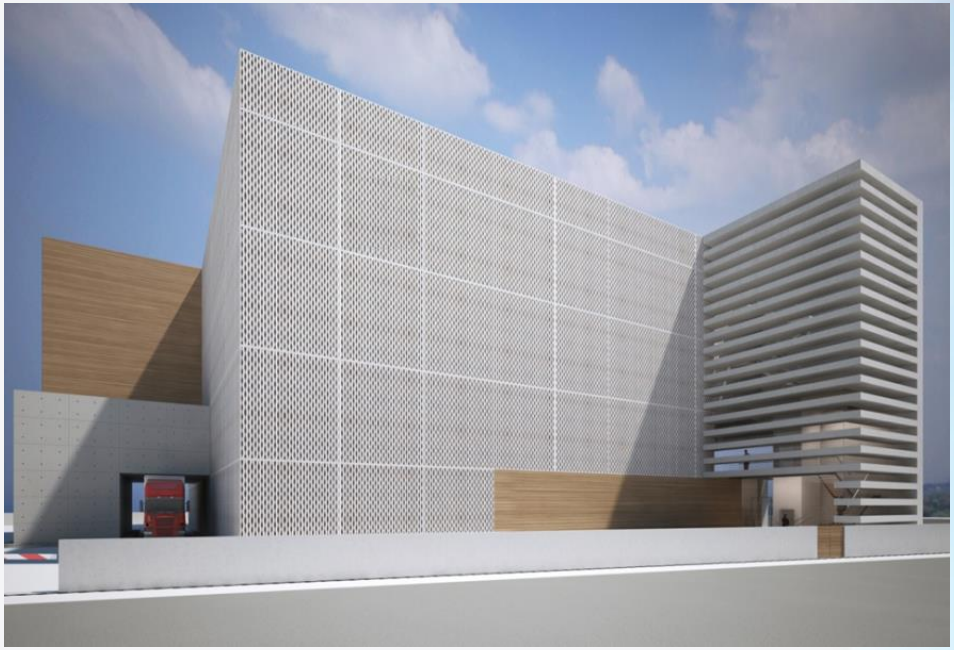
EG2		With the facility supported by all engine generators, isolate engine generator E20C0103-01B for maintenance. Then re-enable the engine generator.	Engine generators E20C0100-01A and E20B0100-01A should continue to serve the data center load.
EG3		With the facility supported by all engine generators, isolate SUPPLY TO UPS board E36C0100-01A for maintenance.	Engine generators E20B0100-01A and E20C0103-01B continue to support the data center load.

Project Stakeholders and Characteristics

- Owner – Mei-Oz Limited
- Project manager – Shimon Katz
- Project management – Poran-Shrem
- Design leader – Osnat Naveh
- Architecture – Skorka
- Electrical – YANAI
- HVAC – Harari Noam
- BMS – EMG
- Communication – Radian
- Cx – LEE Technologies – Schneider Electric
- Spec. and Cx review – DIT
- GC, MEP & Communication - Electra

- Total Area – 10,000 Sq.M.
- DC Area – 2000 Sq.M.
- 420 IT racks
- Day 1 power – 1 MW
- Future growth – 2.5 MW
- Cooling – CRACs, chimney racks
- Preparation for closed-coupled water cooling

TIER III
FACILITY
Mi - Oz Limited
Rotem Data Center
9 June 2015
UPTIME INSTITUTE CERTIFIED



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