

ITRS Facility WG January 31, 2007 Phoenix, AZ



What's New for 2007? Update from Taiwan F2F

► Facility Items from Taiwan F2F

- 2006 approach to Facility TWG
- Equipment Sleep Mode – proposal for integrated fashion
 - Power requirement world wide
 - Green Fab Initiatives – Key focus areas and metrics?
- Lithography
- Update on Adapter Plate and Design for Facilities (focus areas for 2006)
- 300' to 450 what does it mean for facilities?
- Schedule and timeline for re-writes
- 2007 meeting schedule



Philosophical Approach of Facility Working Group

- Improve Cost Reduction of Facility thru improved integration of facility and production equipment
- Improve Schedule efficiency thru Facility BaseBuild and Tool Installation standardization
- Improve Facility operations thru resource conservation and improved facility design criteria



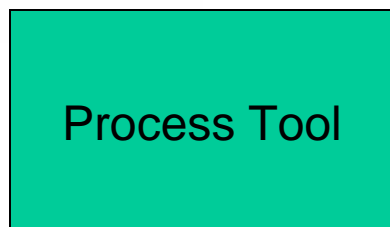
Tool Sleep Mode Current State

- SEMI E54.18 communication protocol between process tools and pumps has been developed
- ISMI has demonstrated pump idle mode by manually reducing pump speed and measuring electrical reduction as well as validating particles
- Toshiba has demonstrated LL pump idle mode while tool was processing wafers with no particle impact

What other parameters (temp, humidity, etc.) are critical for pump chamber integrity during idle mode

Tool Sleep Mode Proposal

GOAL: Reduce tool energy consumption level when tool is not in use – increase tool energy consumption ratio between processing and idle mode



ACTIONS;

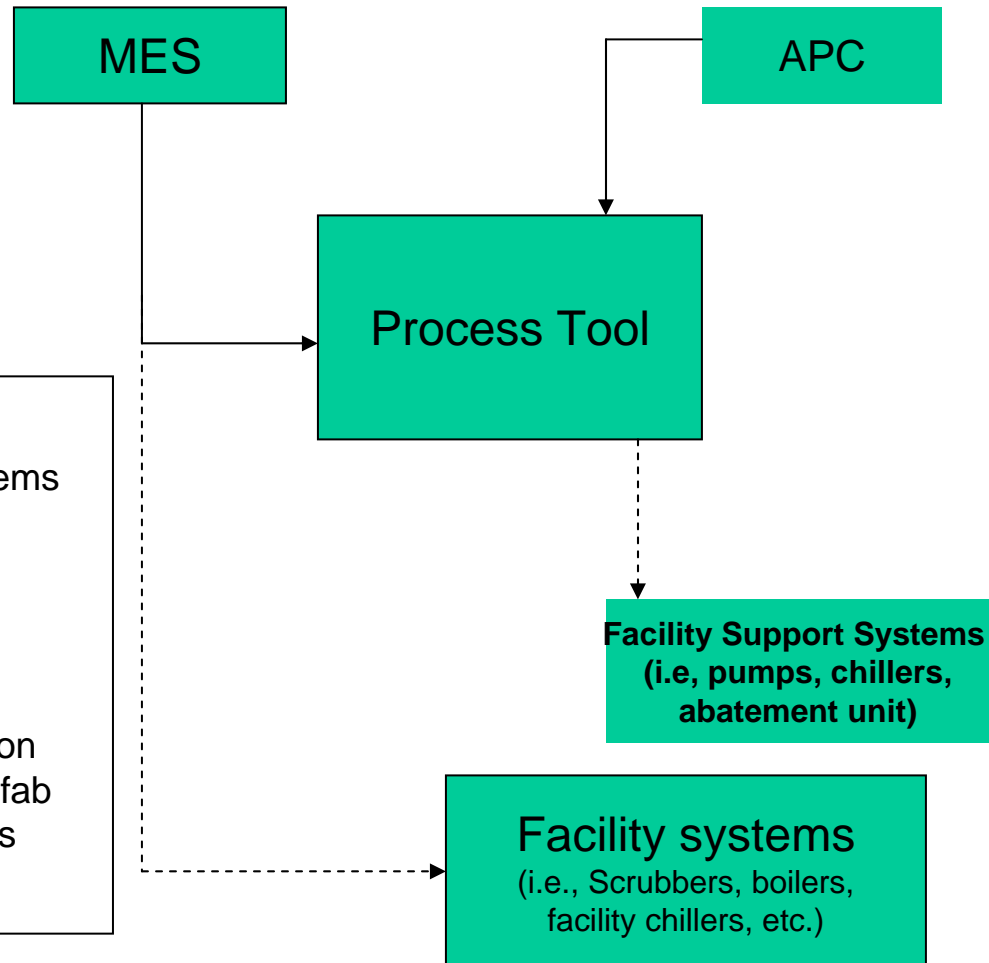
- Identify steps to enable 'Sleep Mode' on process tools and support components when tool in not processing wafers using SEMI E54.18
- Identify potential tool types (i.e., Dielectric, metals, dry etch, diffusion, etc.)
- Define potential savings potential
- Demonstrate feasibility by piloting E54.18 communication between process tools and support equipment

Facility Support Systems
(i.e, pumps, chillers,
abatement unit)



Tool Sleep Mode Longer Term Vision

GOAL: Reduce facility operation cost by enabling facility demand based utilization model - Goal

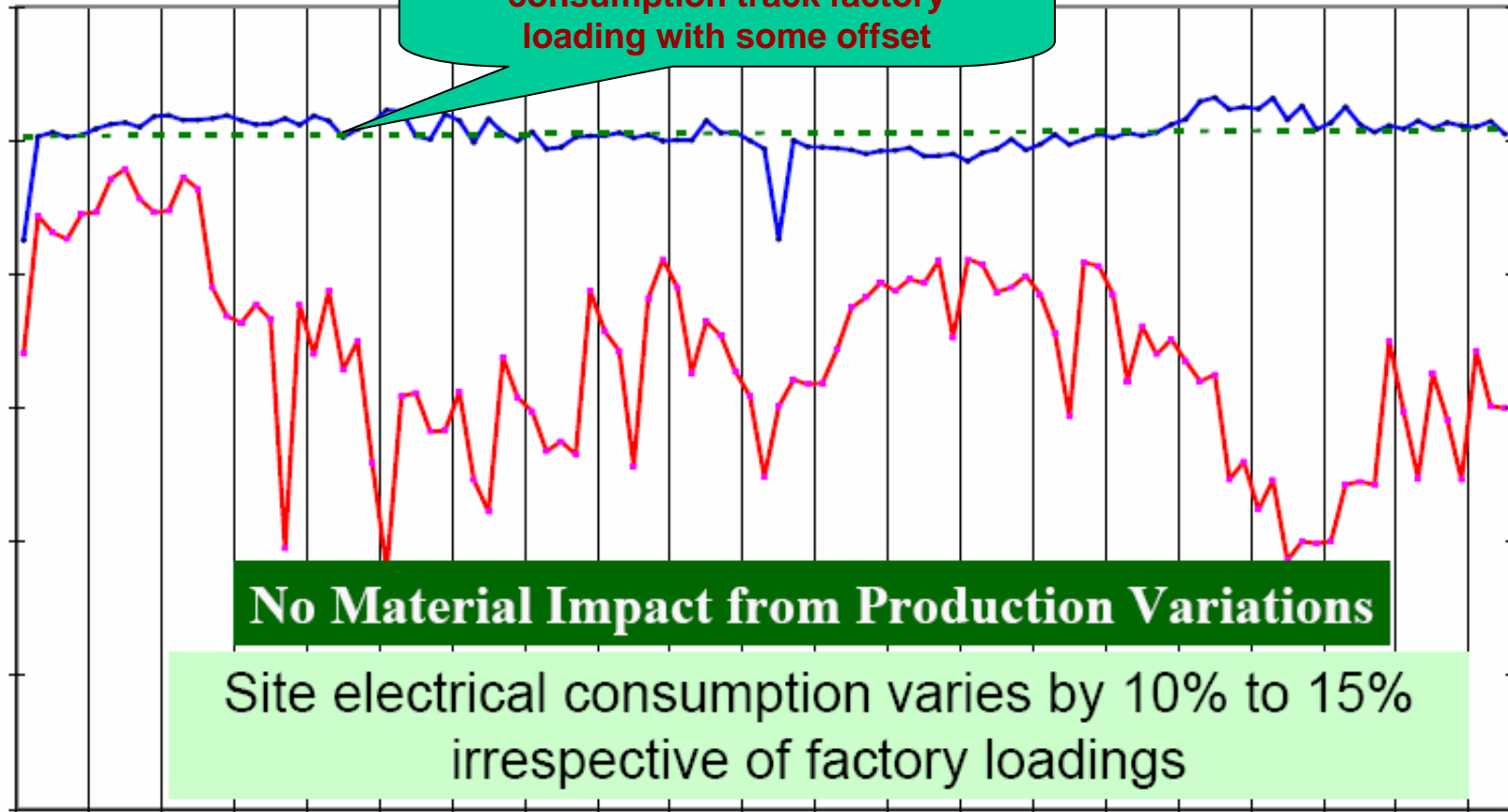


ACTIONS;

- Identify what fab and facility automation systems exists today.
- Identify automation system gaps and define actions and parameters needed to link facility systems to MES system
- Define plans for integrating existing automation systems with new automation systems to link fab wafer management systems to facility systems
- Define cost savings opportunity

Electrical Consumption vs. Wafer Start

Goal would be to make fab energy consumption track factory loading with some offset



No Material Impact from Production Variations

Site electrical consumption varies by 10% to 15% irrespective of factory loadings

Electricity kWh

Wafer Starts

12/3: X axis → Hrs or Weeks or Months? Details missing?

Back



Tool Sleep Mode Next Steps

- Need to utilize all resources avail to realize the energy savings benefit of when tools are not processing wafers
- Propose to have a small sub-team of IC makers, equipment suppliers, third party OEM (pumps, chiller, abatement) as well as STRJ participation, ISMI and Fraunhofer to come up with plans to enable tool 'sleep mode'.

First meeting: Tuesday Feb 6th at 4:30-6:00pm Pacific

Agenda:

- Baseline ourselves by reviewing data from
- ISMI tool idle mode project
- Toshiba data
- Applied Materials data

Contact: Mahmoud Aghel if interested in participating
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Power Requirements World Wide

- Action Required from ITRS Facility group:
 - Develop Position statement around standard voltage to reduce transformation →
 - Investigate, Justify and Recommend (remove 208V, use 480V & 110V)

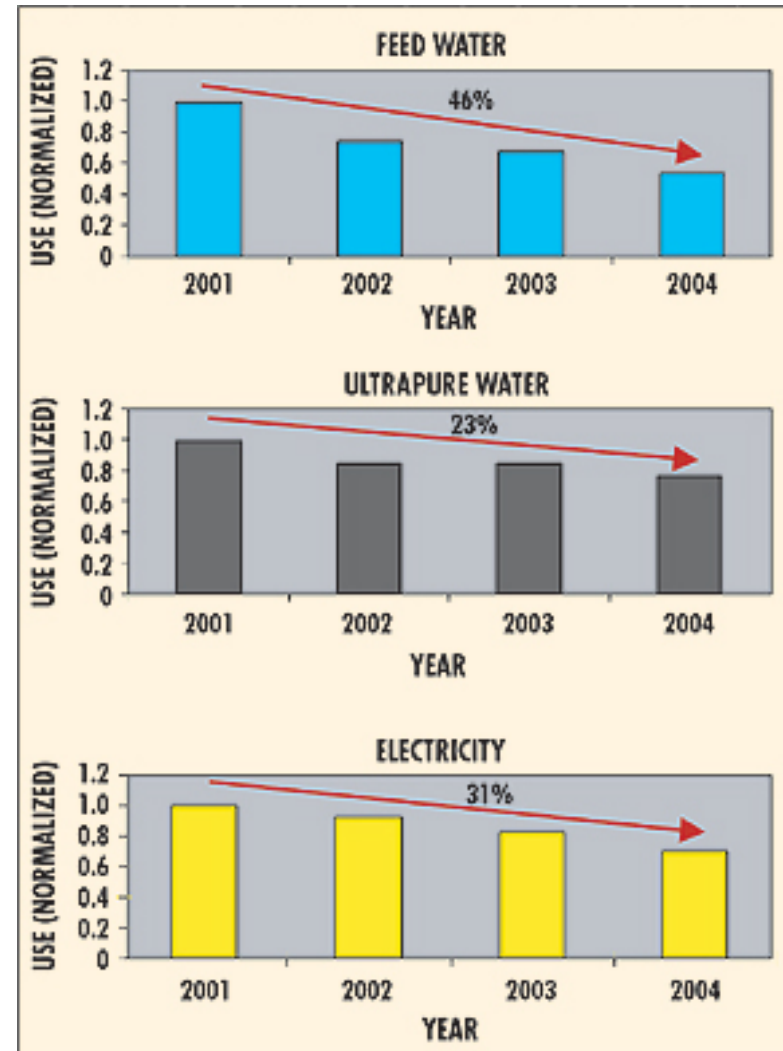


Challenge of Green Fab

3 December 2006

More than Energy Conservation

- Resource Conservation
 - Water
 - Wastes
 - Production Materials
 - Gases, Chemistries
 - Hazardous Materials
 - Cleanliness



Introduction to Green Initiatives Advanced Technology Sector

- Green Grid (Data Centers) - information technology professionals
 - lower the overall consumption of power in datacenters – use of reduced power servers
- Green Building Initiative – accelerate the adoption of sustainable building practices
 - energy-efficiency, healthier and environmentally sound
 - GREEN GLOBES program
- US Green Building Council - promote buildings that are environmentally responsible, profitable and healthy places to live and work
 - LEED (Leadership in Environmental and Energy Design) programs



Introduction to Green Globes™

- Accelerate the adoption of building practices that result in energy-efficient, healthier and environmentally sustainable buildings
 - Promoting credible and practical green building approaches for residential and commercial construction.
- Green Globes emphasizes strategies for
 - Project Management
 - Site
 - Energy
 - Water
 - Resources
 - Emissions and Other Impacts
 - Indoor Environment



Introduction to LEED™

- Provides a complete framework for assessing building performance and meeting sustainability goals.
- LEED emphasizes strategies for
 - sustainable site development
 - water savings
 - energy efficiency
 - materials selection
 - indoor environmental quality
 - <http://www.usgbc.org/>



Current LEED Rating Systems

- LEED-NC: New commercial construction and major renovation projects
- LEED-EB: Existing building operations
- LEED-CI: Commercial interiors projects
- LEED-CS: Core and shell projects
- LEED-H: Homes
- LEED-ND: Neighborhood development
- LEED Application Guides: Retail, Multiple Buildings/Campuses, Schools, Healthcare, Laboratories, Lodging



LEED - NC

- LEED for New Construction and Major Renovations (LEED-NC)
 - A green building rating system that was designed to guide and distinguish high-performance commercial and institutional projects,
 - Focus on office buildings. LEED – NC has been applied to K-12 schools, multi-unit residential buildings, manufacturing plants, laboratories, other building types.





LEED Application Guides

- Within the different markets addressed by LEED, technical features of the buildings or the buildings' processes may demand special treatment
- LEED Application Guides provide specific advice on how to apply LEED in these cases, and on any special exceptions or interpretations*

*USGBC website – LEED Applications Guides





LEED Application Guides

- The USGBC is currently developing application guides for:
 - Healthcare - to address chemical sensitivity issues, process loads, and other issues relevant to healthcare buildings
 - Laboratories – to address the ventilation issues of Laboratories, as well as process loads and other considerations (EPA Labs21 Energy Performance Criteria
 - Schools - K-12 schools and school districts to address student transportation, occupancy definition, and classroom acoustics

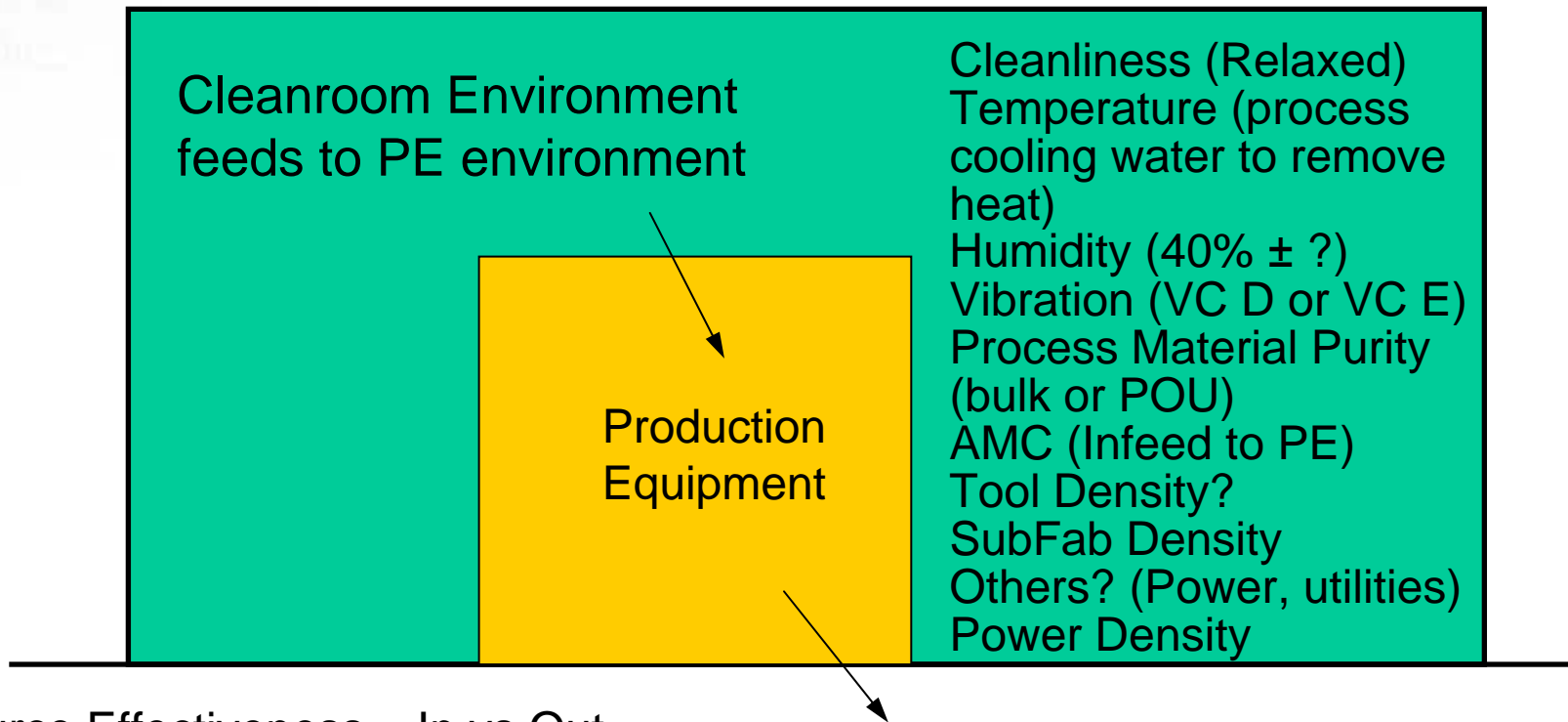


ISMI and ITRS

- EHS initiative with Factory Integration to understand how the integrate Sustainability features as part of the Facility and EHS requirements
- Need to understand “Green” definitions and facility impacts:
 - energy
 - infrastructure inputs and outputs
 - resources
 - environment



Facility/Production Equipment Interface “Greening” the Fab Issues



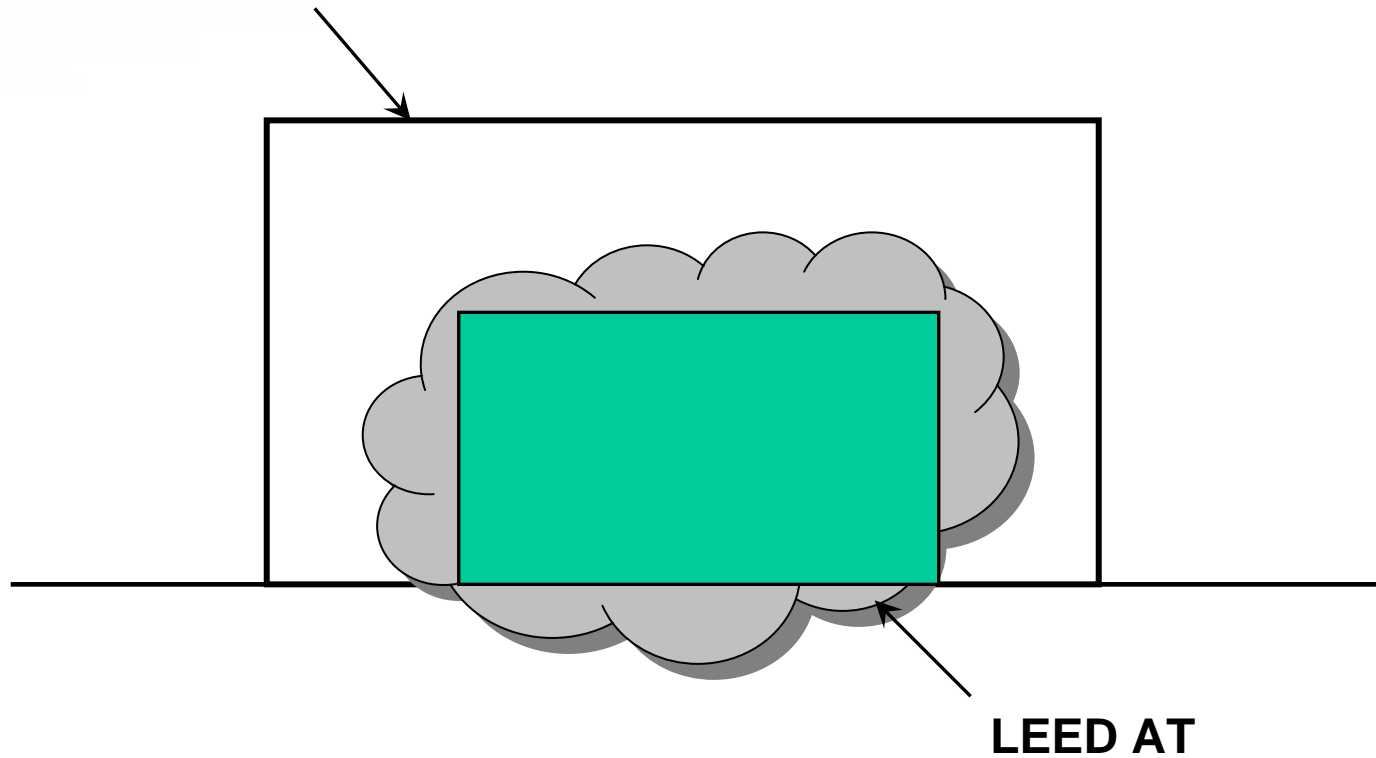
Resource Effectiveness – In vs Out
Power (HVAC, Tools)
Production Material
Water
Chemicals
Gases

PE Waste feeds to Facility
“Greeness”



LEED™ AT Concept

LEED NC



“Greening” the Fab *CREATE*’s LEED™ AT Concept

- Three parameters: the rows
 - Energy (Power)
 - Natural Resources (water, copper (?), steel (?), etc)
 - Non-Product Output (waste streams)
- Four scope areas: the columns
 - Facility Systems (CUB, HVAC, Process cooling, etc)
 - Process (process support systems – N2, O2, chemistries, gases)
 - Building (physical structures)
 - Site (land, orientation, proximity to transportation)



“Greening” the Fab LEED™ AT Concept

- Each parameter was considered to have an equal or 1/3 impact on the parameters.
 - Determine distribution of impact of the parameters on the scope,
 - For example, approx 60% of the energy is process, 35% on facility systems, 5% on the building.
 - Points assigned to each cell.

	Facility Systems	Process	Building	Site
Energy	12	20	2	N/A
Natural Resources	8	15	5	5
Non-Product Output	4	29	N/A	N/A
Total	24	64	7	5



The Challenge

- Defining the Sustainable Fab
- System for Performance Recognition
- Measurements and Metrics for
 - ITRS – Factory Integration and EHS
 - ISMI
 - LEED or Green Globes?
- Global Issues need to be enfolded into Metrics and reconciled

All previous slides courtesy
of ASU CREATE



Waiting on update from James ISMI 2007 Green Fab Project

- Deliverable: *Develop guidance for “Green Fabs” to assist in designing and rating highly efficient (environmental resources and energy) semiconductor fabrication facilities, in the form of an Industry Guideline and MC Workshops.*
 - TBD: What shape will this take?
 - *A Rating System for Fabs (self certification or Third Party)*
 - *An Application Guide for LEED (NC or EB) for Fabs*
 - *A prescriptive solution for Green Fabs*
- What are the initial Major Tasks to complete this?
 - **Form ISMI-led Industry Work Group to contribute to the development of the criteria and guidance; establish Work Group as a US Green Building Council Technical Advisory group (TAG).**
 - **Assess LEED-NC and LEED-EB criteria for applicability and gaps pertaining to assessment and qualification of semiconductor fabs.**
 - **Others TBD as scope is developed**

Slide courtesy of
James Beasley, ISMI



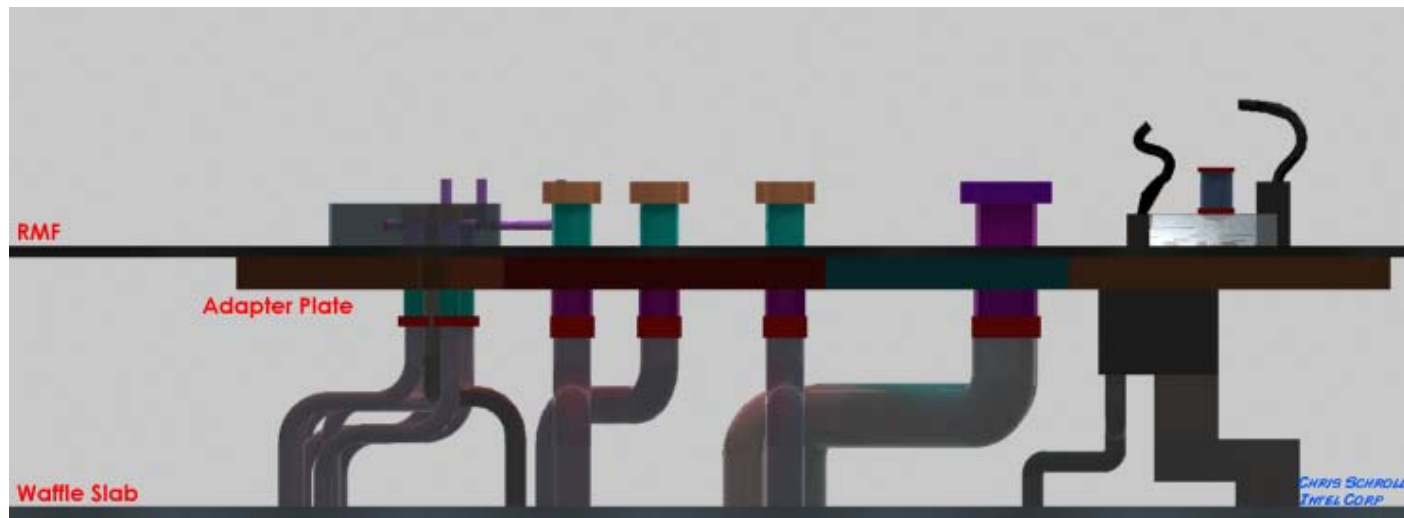
Lithography Challenges

- What guidelines or constraints should be set for Litho EUV tools?
- Weight constraints for facilities (Litho)
 - Litho WG needs facility weight threshold for equipment
 - Equip weight currently 50+ tons
- Power consumption - nominal 250 KW/tool
- Water consumption
- Height for facilities
- Notes from last FI and Litho cross TWG meeting F2F

By adding huge vacuum chambers (the pumps can be in the sub-fab but the chamber will be in the fab), the weight of the EUV will be 50-60 tons. Need to control H₂O and Hydro Carbon for optimum optics. UPW temperature: $<\pm 1^{\circ}\text{C}$ and gradient = $<0.1^{\circ}\text{C}/10\text{min}$. How to condition the incoming wafers to meet temperature needs? How many loadports needed to maintain continuous feeding? Expect the height to go up by 0.5 to 1 meter for 1.6 Numerical Aperture EUV (14 feet height needed). Lens diameter is an issue.

Adapter Plate Concept

- What are they?
 - Designed by the process tool supplier as an integral component of the process tool
 - Contains all tool points of connections (POCs)
 - Shipped prior to the main tool enabling all prefacility work to be done prior to main tool dock



High Level Design Expectations

- Application of the tool adapter plate should reduce the overall process tool cost of ownership
- Contains *all* process tool points of connection
- Tool Footprint should not increase
- Ensure proper alignment between tool and adapter plate can be achieved and maintained
- Utilize common connector types and sizes
- Utilize single point of connection to enable internal tool manifolding

Adapter Plate Metrics for Facility Tables

- Update Adapter Plate in potential solutions to enable rapid tool install and schedule efficiency
- Ensure adapter plate metrics timing and % of implementation is tied to “Tool install Metric”
- Two options:
 1. % of qualified tools utilizing adapter plates
Definition of Adapter Plate Qualified Tools
 - Process Tools with > 7 POC's and > 3 utility types = Adapter Plate Required
 - Process Tools with < 7 POC's = TBD
 2. Evaluate differences in equipment (tool type or # of connection points) - Based on Functional area
 - Litho
 - Etch
 - Diffusion
 - Thin Films
 - Implant
 - Planar
 - Metrology
 3. Comments, Input??

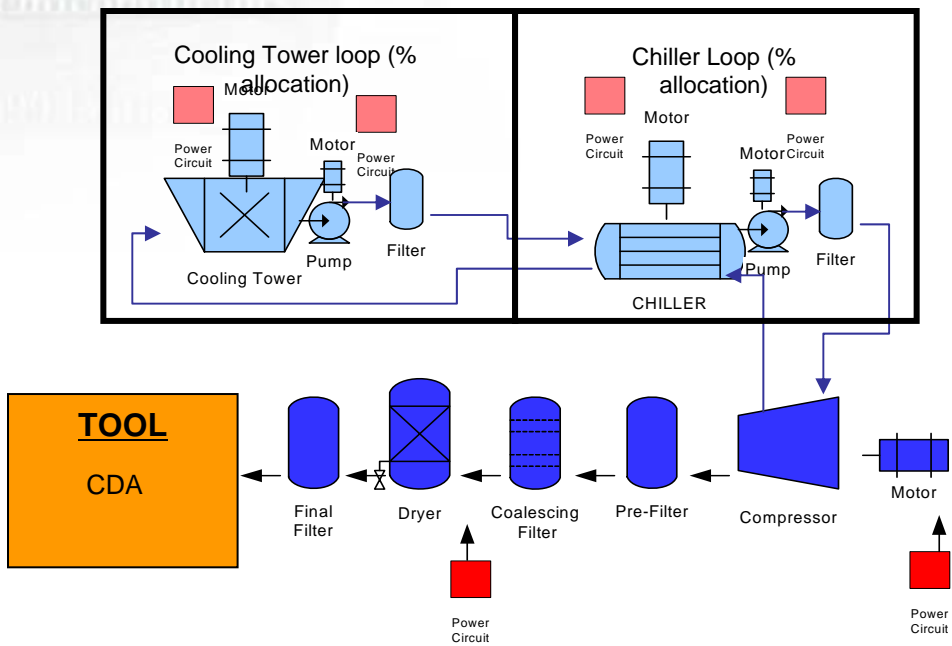


Potential Solutions

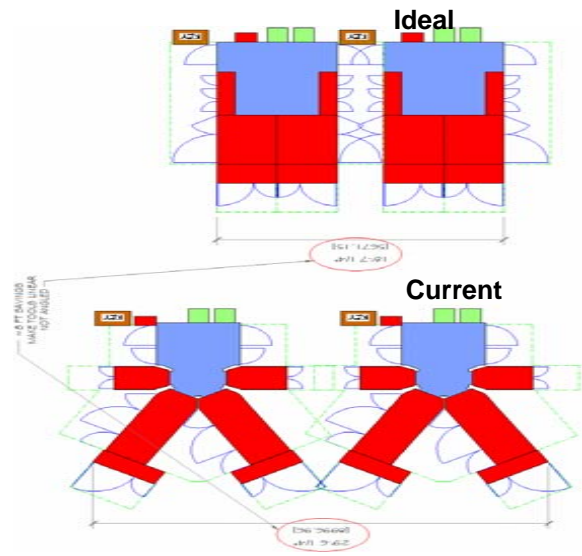
Adapter Plate Progress

- SEMI guideline kicked off in 2006
- Divided team into Sub-team based on expertise
 - Mechanical / Process
 - Electrical
 - Architectural
- Developing plans to complete in 2007

Design for Facilities (DFF)



Utility – optimal design/use



Layout design – Optimal footprint

- SEMI guideline completed informational ballot process
- Plans for technical balloting process in March '07



300' to 450 what does it mean for facilities?

- Issues looking forward
 - Extendibility of current fabs
 - watch out for increased sub-fab area
 - abatement point-of-use and new material issues
 - Height, vibration, floor density

► **Apr 23 – 24 ITRS ITWG/IRC meeting in Annecy, France**

2007 draft tables are due & reviewed by ITWGs & CrossTWGs

Jun 30 Presentation Drafts due for preparing the July meeting materials

1 page text summary of key changes to tables

► **Jul 16 – 17 ITRS ITWG/IRC meeting in San Francisco**

2007 drafts are reviewed by ITWGs and CrossTWGs

July 20 ALL FINAL tables due

Aug 31 ALL FINAL chapter drafts [tables, figures, text] due

**Sep 15 *2007 ITRS content is frozen*
*[late material deferred to 2008 ITRS]***

December 2007 ITRS is posted online for the public

2007 Facility TWG Meeting Schedule

- Wednesday afternoons – 4:00 pm to 5:00 pm Mountain Time
 - February 21
 - March 21
 - April 18
 - May 23
 - June 19
- Additional F2F meeting to be held in conjunction with the Sematech Facility Counsel meeting March 8th from 2:00 to 5:00 PM, Austin, Texas. Venue TBD
- ITRS FI F2F; Annecy, France; April 22-23
- ITRS FI F2F; San Francisco; July 15-16



Back up

Actions Required From Previous Meetings

- **AR: Kandi to work with AI to schedule a mtg w/ FEP and ESH – new materials, delivery, abatement. What are the new processes, etc**
- **AR: FF to work with ESH on Green fab and Energy conservation. FF (Kandi) to schedule a mtg. with ESH and ISMI to discuss these issues (energy conservation in particular).**