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ITI & Technet 9/29 F2F Presentation: ODD & Power Supplies

Additional submitted attachment is included below.

ODD / PSU Idle Reduction

ODD Trends

- 4K (Ultra HD) is current limit of resolution capabilities in BD
- 66GB dual 100 GB triple layer
- Network bandwidth improvements and application/SW download are displacing software distribution on OD
- Music transition to download MP3 and cloud has displaced music application
- Movies transitioning to download / streaming displacing movie distribution over DVD/BD
- Attach rates in mobile and DT PC's continues to decline

ODD idle reduction opportunities

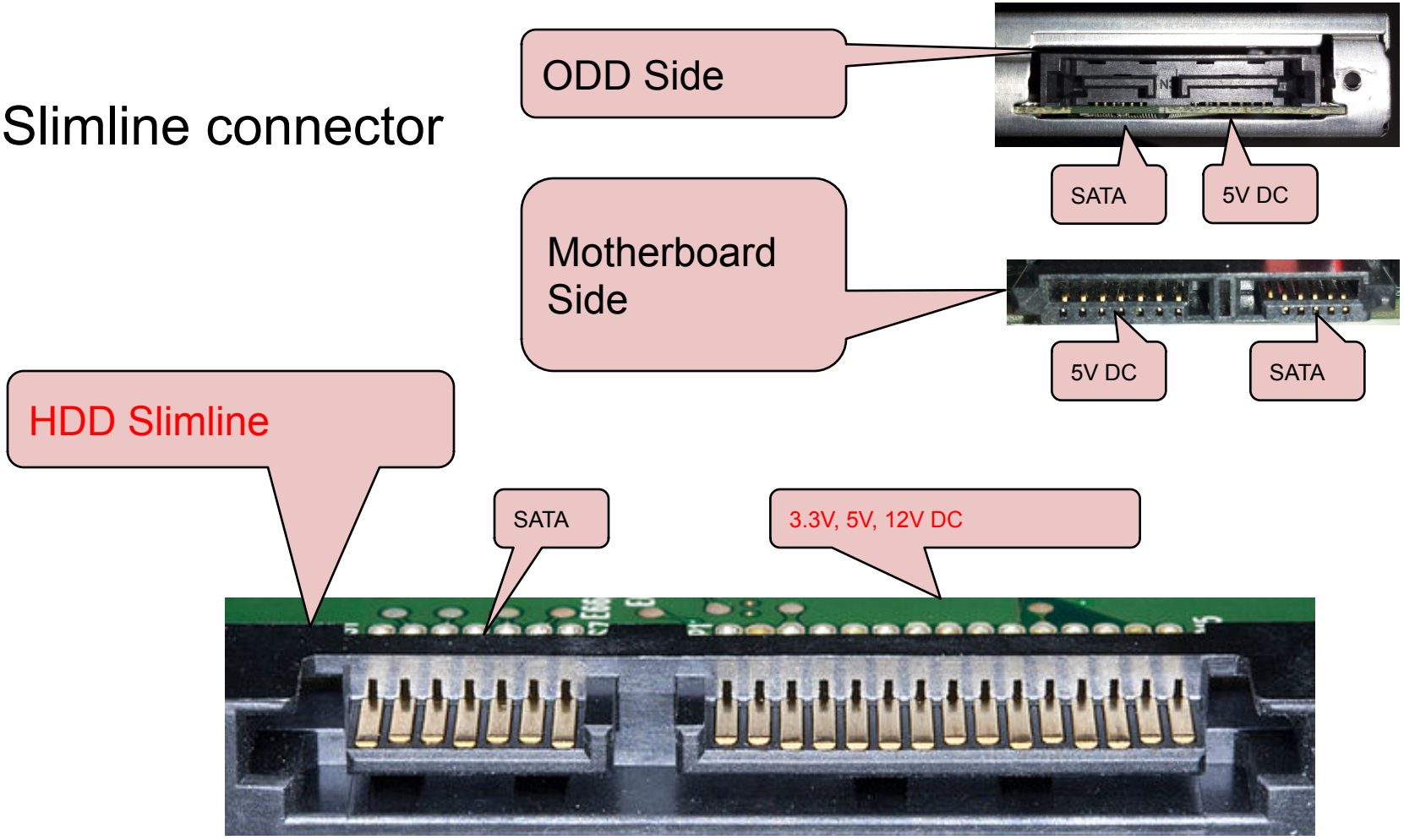
- Low power idle drives
- 200-500 mW idle power
- Zero Power ODD implementation
  - Design changes required to maintain functionality of drive open/close button
  - Alert / media change indication from drive (prevent OS from polling for media change)
  - Mobile / slim line drives with new connectors enable capability in DT other design changes needed

DT ZPODD change requirements

- Need to consider support
  - On Host (PCH) side
    - Make sure the host is connected to the right pins/ signal on the connector
  - BIOS/ Driver
    - BIOS has to properly configure and control GPIO's to turn ON/OFF power
    - Driver needs to make sure device is powered off appropriately
  - On Motherboard
    - Need the slimline connector
    - Power off circuitry (5V rail controlled by a FET connected to GPIO)
  - On Device
    - Need to use mobile slimline optical drives

ZPODD Platform Level Support

Slimline connector



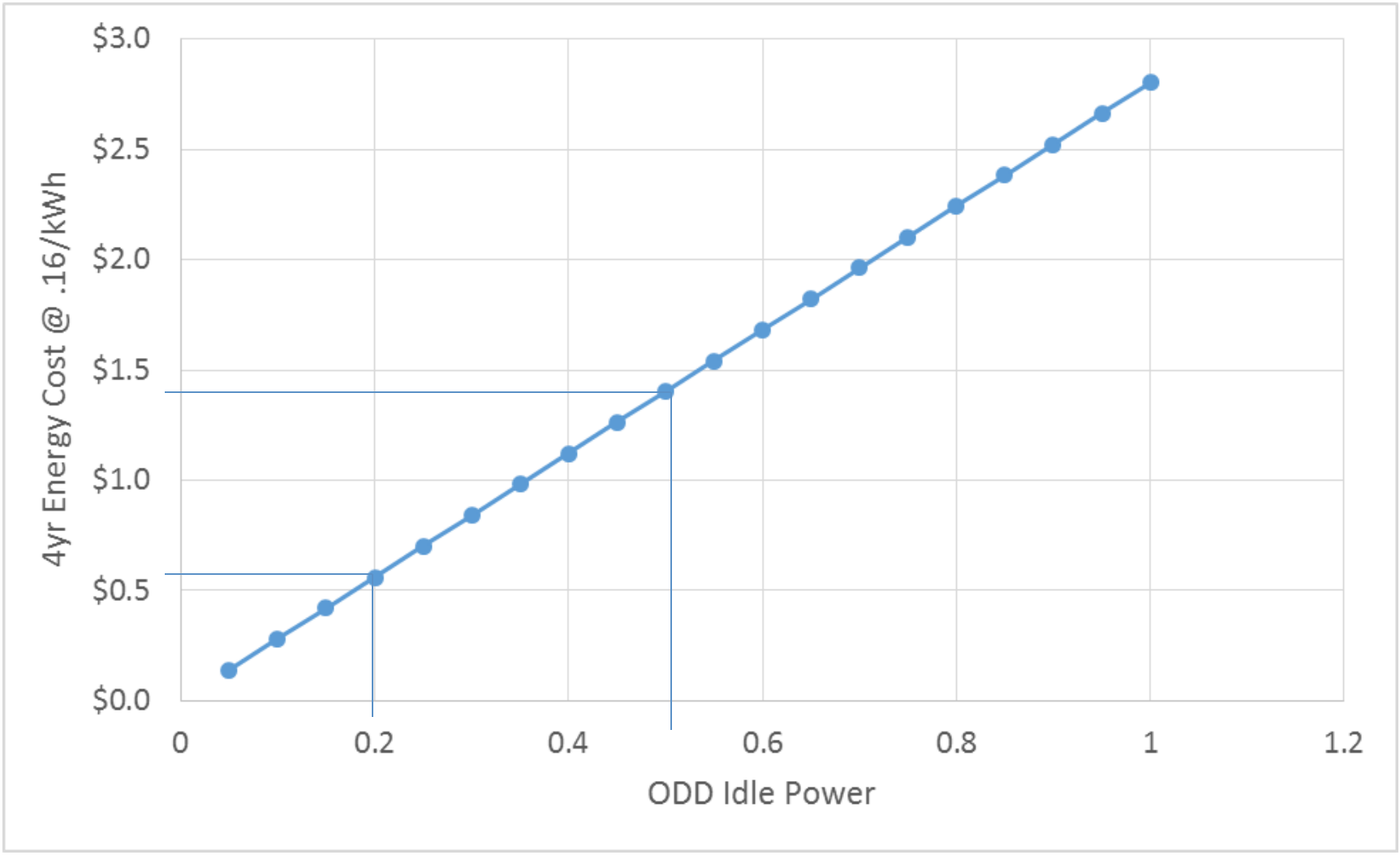
ZPODD Details

- Zero power ODD is implemented on mobile systems using a special type of connector standard called “slimline SATA”
- This new connector has a new power connection with 6 pins
- In addition to +5V and GND two new signals were added –
  - Device Present (DP)
  - Manufacturing Diagnostic/ Device Attention (MD/ DA).

BOM Impact

- Drive Impact - For moving to slimline ODD drive:
  - For **DVD-RW** drives: **$4** ($15 for DT (or half height) and $19 for Slimline)
  - For **Blu-ray** drives: (BD combo and BD writer) **no cost** difference.
- Cost impact to get the slimline connector on the motherboards: **$0.95**
- Power off circuitry Impact: **$0.16**
  - For signal Pull up
- Potential BOM impact could be an extension cable required for extending in DT chassis - **$7-$10**
- Total Cost Impact:
  - Considering DVD drives: $4+$0.95+$0.16 -> **$5.11**
  - Considering BD drives: $0.95+$0.16 -> **$1.11**

Potential Energy cost savings



4yr energy cost – idle 4380 hrs/yr @ $0.16/kWh

Conclusions / Next Steps

- With DVD still majority attach for ODD ZPODD costs exceed benefits
  - ZPODD on BD @ $1.11 only cost effective if BD idle power > 0.4 W
  - ZPODD on DVD @ ~$5 only cost effective if DVD idle power > ~1.8W
  - All systems capable of ODD will suffer much of the costs even if they don't ship with ODD
- Short term
  - select low idle power ODD's (ability t support customer needs TDB
  - Work with ODD Suppliers to minimize idle power without ZPODD implementation
- Medium term and long term
  - Smaller form factors implement slim line ODD drives

Concerns:

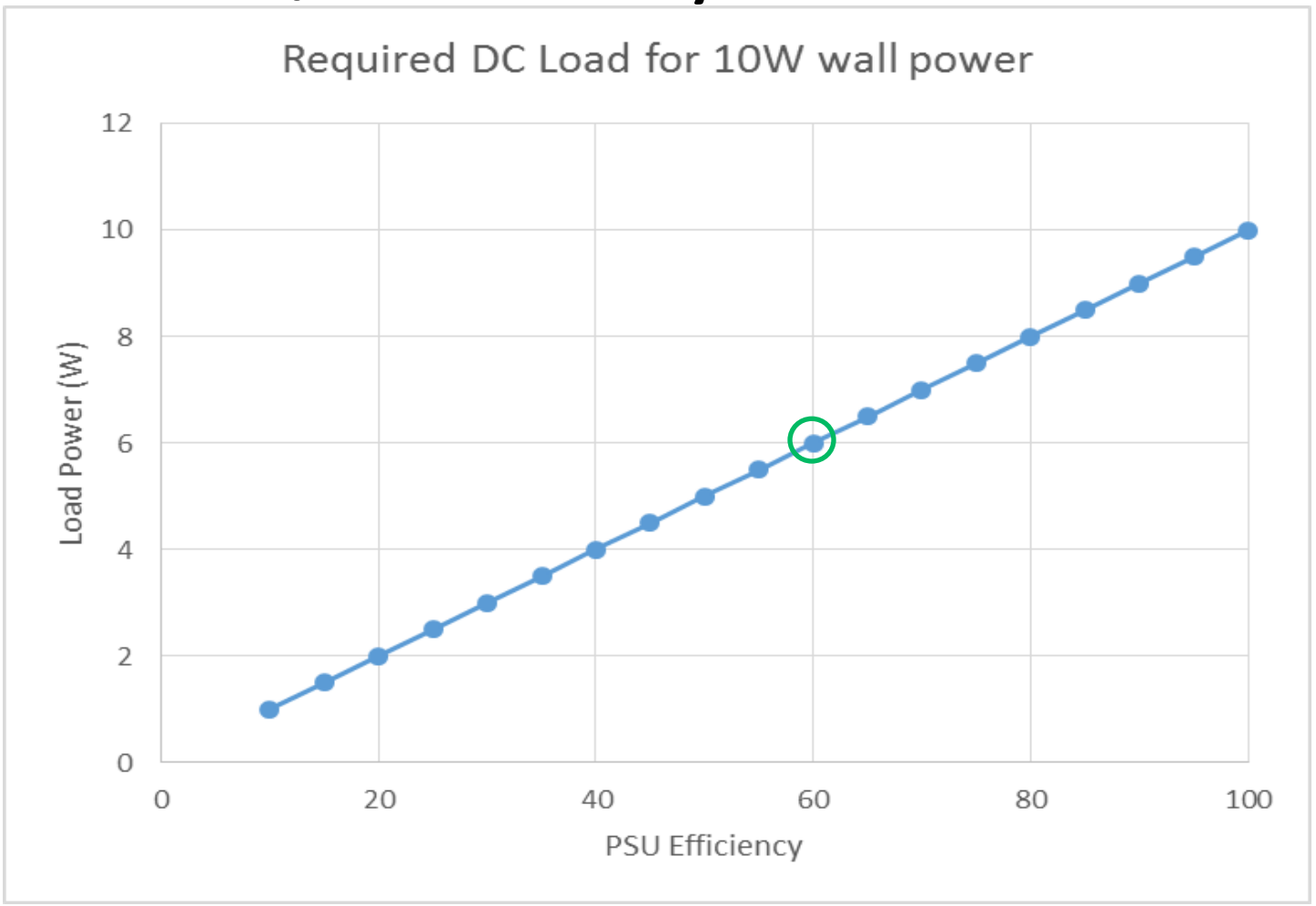
- Tight limits dependent upon idle power values of ODDs may add significant risk to production
  - Little data available on variability of these levels

DESK TOP PSU IDLE POWER EFFICIENCY STATUS AND IMPROVEMENTS

DT Trends

- Lower Energy consumption trends
  - Smaller form factors
  - Reduced TDP and max power Processors / chipsets
  - Reduced expansion capabilities
  - Natural silicon idle and active power reductions over time
    - Process improvements
    - Higher integration
- Increasing Energy Consumption trends
  - Higher bandwidth network connectivity
  - Addition of wireless connectivity
  - Larger numbers of expansion connectors / ports
  - Higher display resolution
  - Higher performance demands
    - More complicated code with similar responsiveness expectations
- Idle power reductions forcing lower PSU operating points
  - PSU design changes may be needed to prevent negative returns on idle power reduction investments

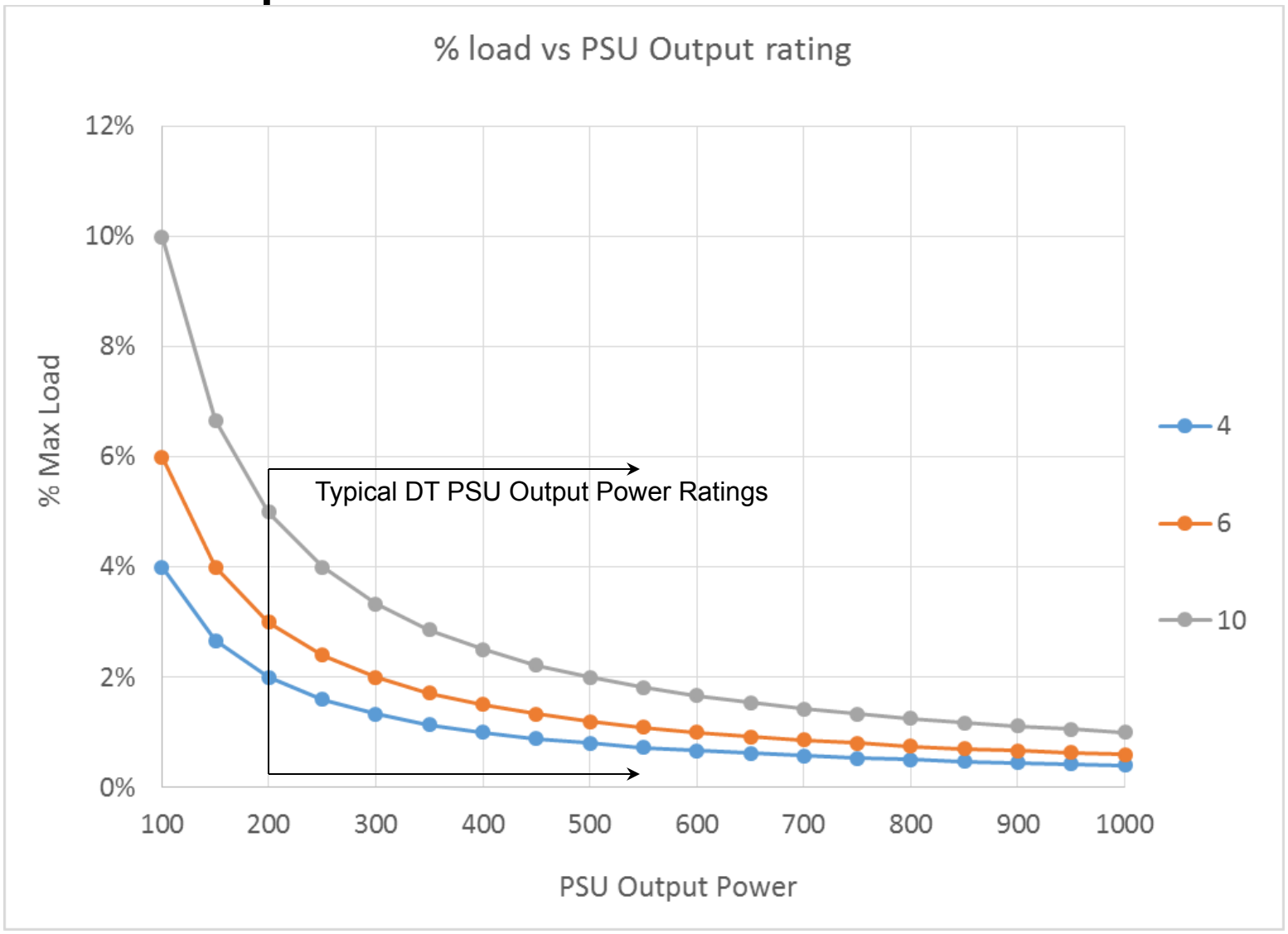
Load / Efficiency for 10W Idle



- Load power vs PSU Efficiency required to hit 10W wall power

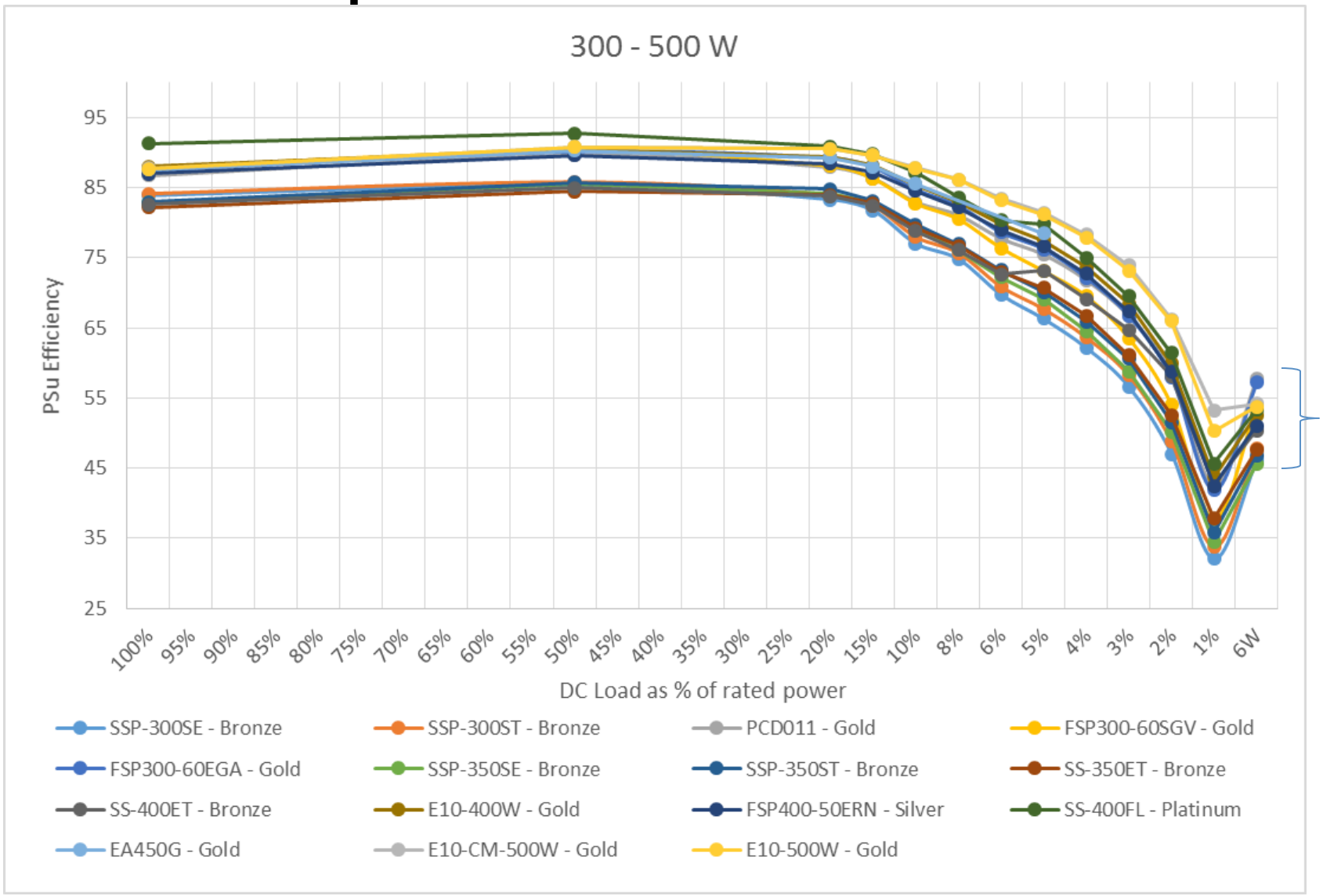
○ 6W Load Power point selected for further analysis in following slides

Idle power Reduction Limitations



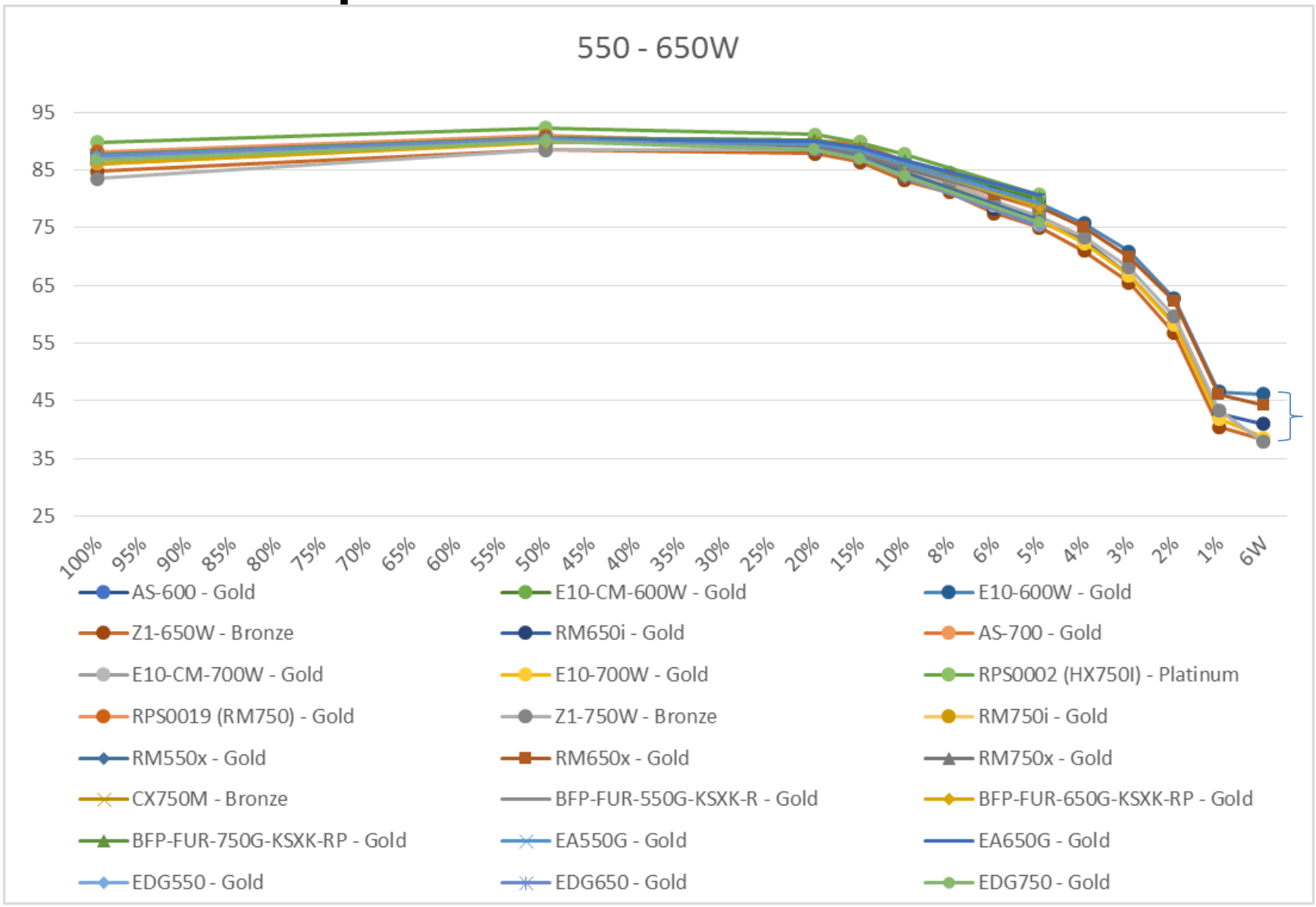
3 curves are 4, 6 and 10 watt idle load power
Proposed Idle power limits forcing PSU operation below 6% rated load

Sample of PSU Eff. Vs Load



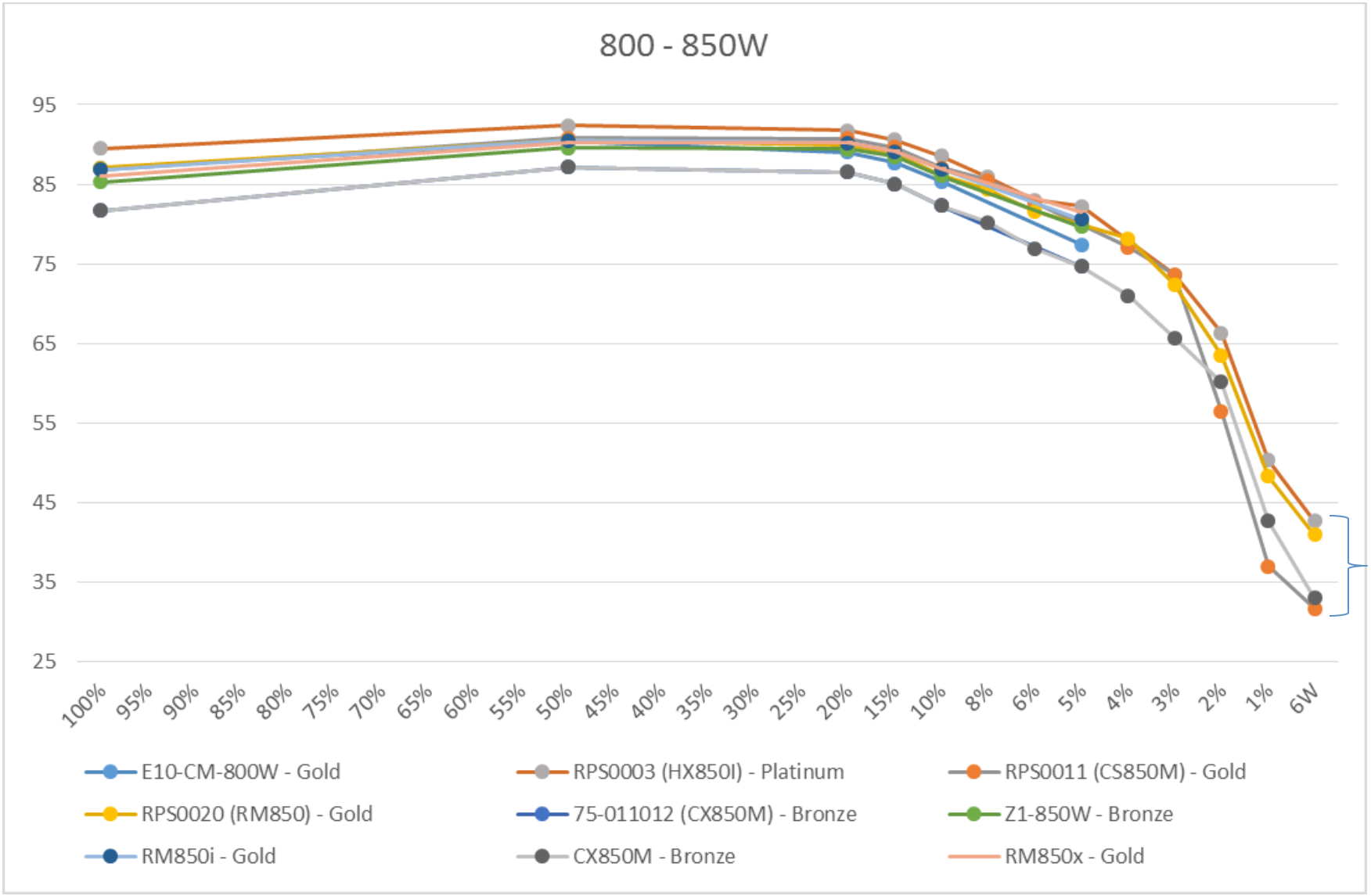
~46 to 58% Eff. @ 6W

Sample of PSU Eff. Vs Load



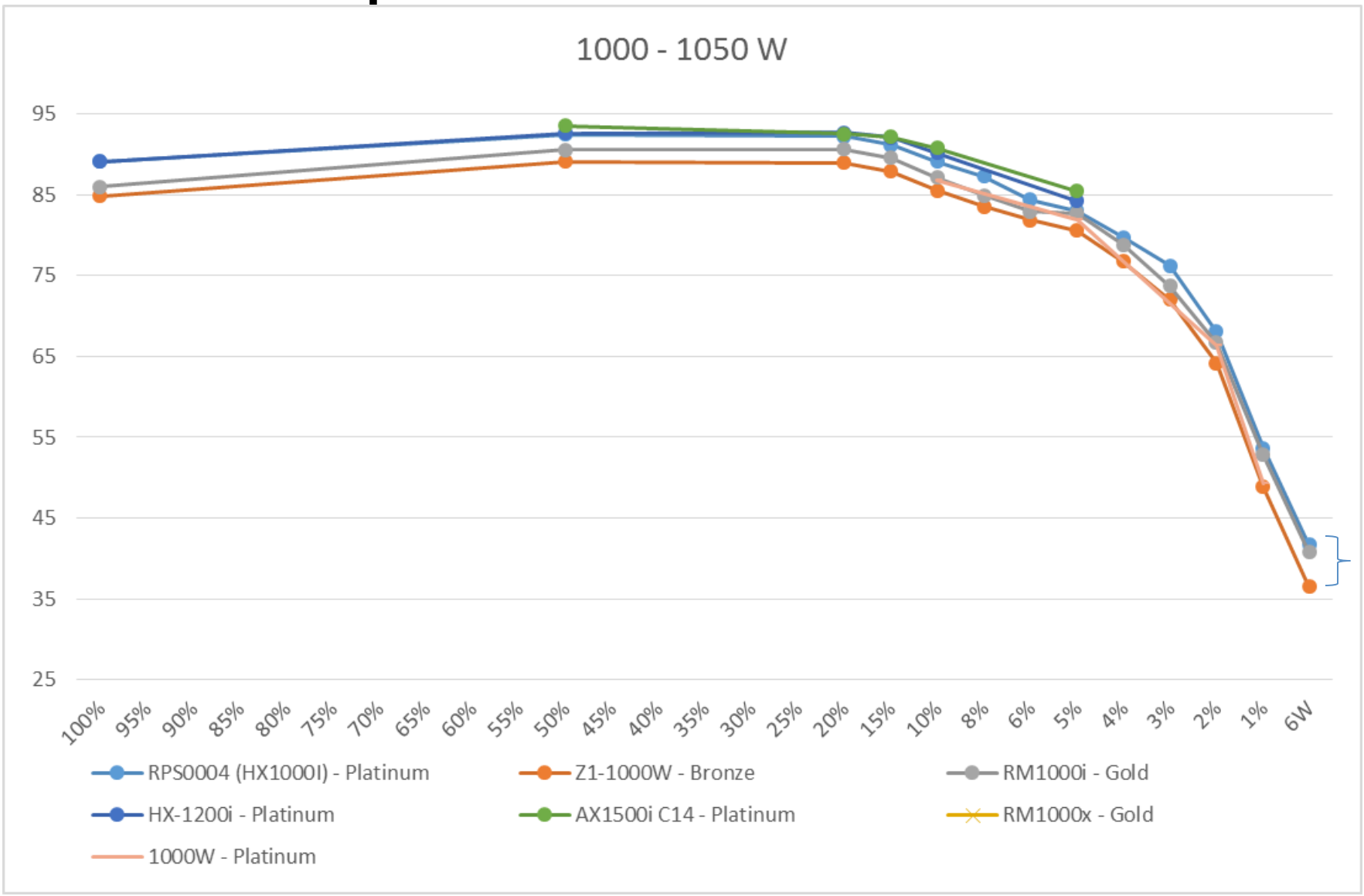
~36 to 46% Eff. @ 6W

Sample of PSU Eff. Vs Load

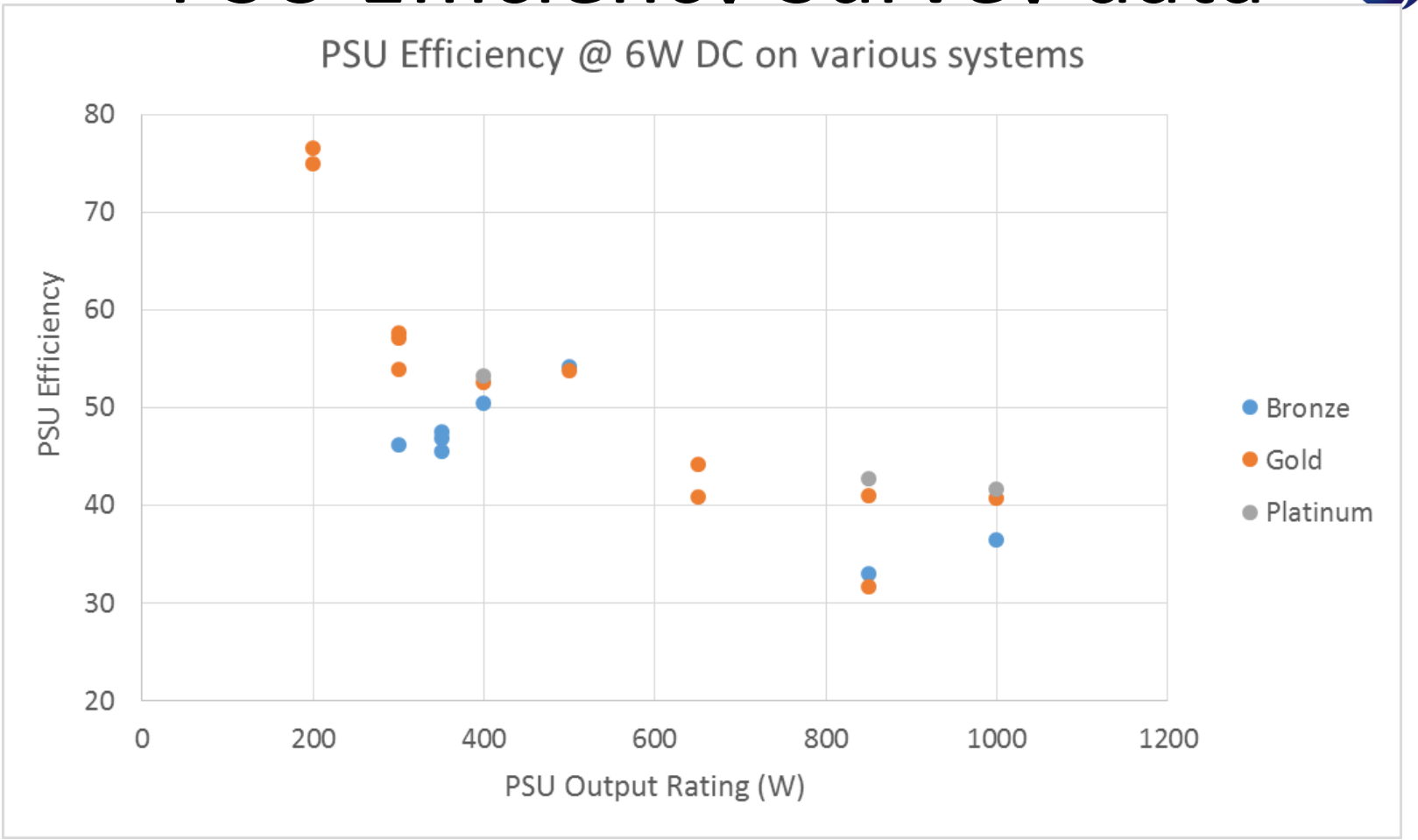


~30 to 43% Eff. @ 6W

Sample of PSU Eff. Vs Load

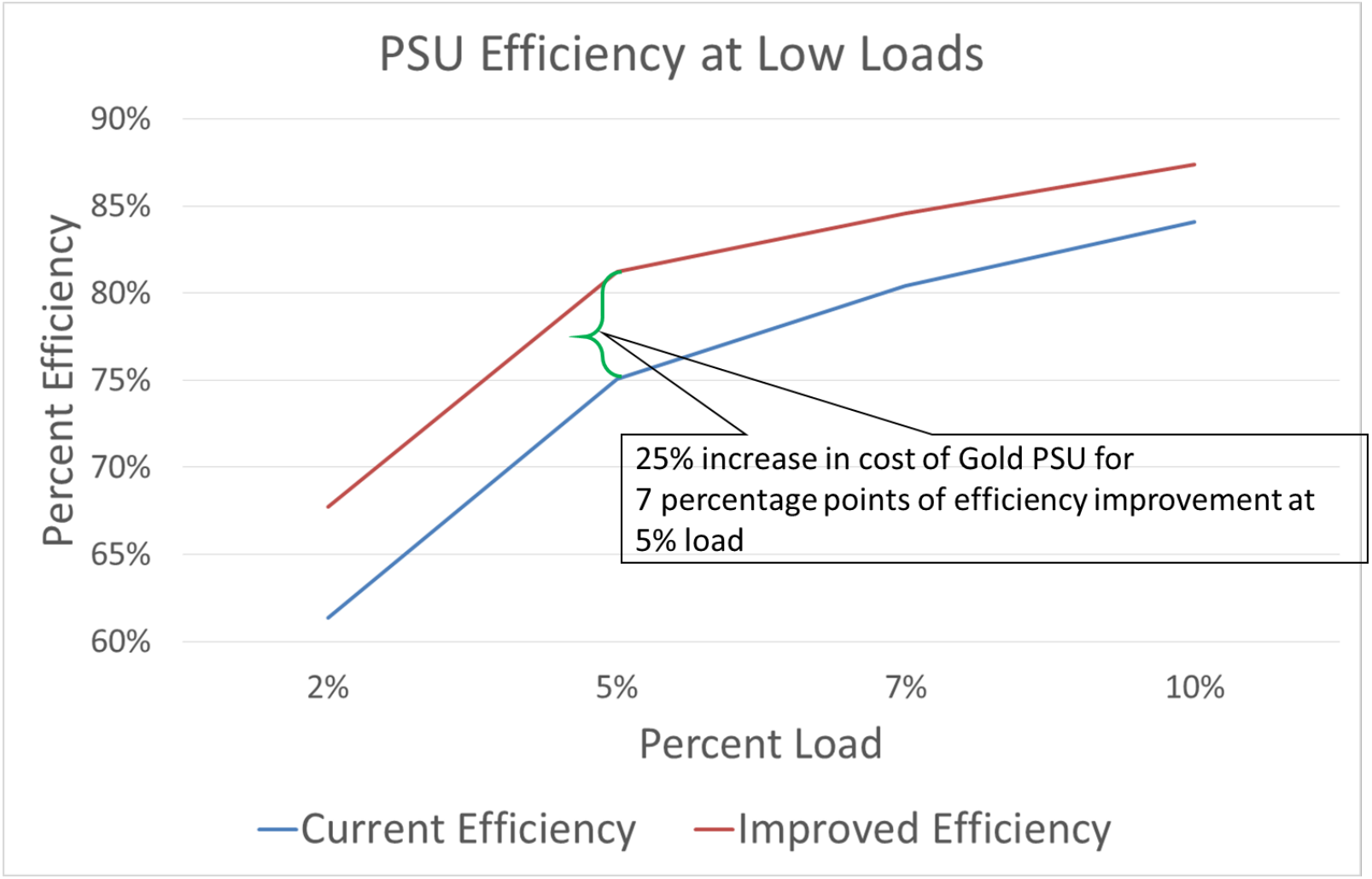


PSU Efficiencv Survev data



- @ 6W Load power existing surveyed PSU's >= 300W have inadequate Efficiencies to hit 10W idle power limit
- PSU Changes will be essential to 10W or lower idle power (PSU >= 300w)
  - Achievable Efficiencies and resultant costs currently being evaluated

PSU Eff. Cost Estimates



Earlier PSU Cost data

Efficiency Baseline APFC 68% Efficient	300 Watts OEM Cost/ Consumer Cost	460 Watts OEM Cost/ Consumer Cost	270 Watts OEM Cost/ Consumer Cost
80+ Bronze	$2.35/$3.80	$3.65/$5.95	$2.55/$4.15
80+ Silver	$5.00/$8.15	$7.10/$11.55	$4.85/$7.90
80+ Gold	$9.15/14.90	$13.65/$22.20	$8.60/$14.00
80+ Platinum	Not available in multi output format	Not available in multi output format	Not available in multi output format

- ITI aggregated costing information
- IOU part replacement analysis relied on Gold level PSU
- End User Cost should be at least 14.00 just for the PSU changes on systems with APFC PSU's
- $10 cost adder required for systems that have to transition from Bronze to Gold

- APFC to Low load Eff. optimized GOLD PSU likely closer to 1.25*14 or $17.5

PSU Development timeline

	Time (wks)	
Task	Best case	Typical-Long
Design new PSU	5	8
PCB Layout	2	2
Build Proto PSU	2	3
Testing / Validation	3	5
Design Changes / Optimizations	2	4
Preproduction layout/manufacture / test	5	6
Manufacture Production ready PSU proto systems	3	4
PSU Safety / regulatory certifications (Production quality hardware required)	12	20
Manufacture Volume production systems	2	3
Deliver to OEM	1	2
Manufactrure PC Systems	3	4
Ship to distribution / sales outlets	5	5
Time start to production ready systems in market (wks)	45	66
Time start to production ready systems in market (yrs)	0.9	1.32

Note: Changes to silicon controller add 9 to 18 months to this schedule
Issues at any point in schedule may require iteration of design build (6-8wks)

PSU Light Load Eff. Cont.

- Opens/Concerns:

1. Price data point based upon retail analysis
   - ~$3.25 per % of increased eff. above 70% (retail, single unit purchase)
     - to the consumer, low cost PSU to Titanium jump = 24(%)*$3.25 = +$78

       ex: 700W: $55 AVG to $132 AVG (2.4x)
     - low cost PSU is not baseline. Energy Star/Bronze supply is baseline.

       ex: 11(%)*$3.25 = +$36, $91 AVG to $132 AVG (1.5x)

2. Stability – Some PSU's have minimum load power levels to maintain stability

PSU Light Load Cont:

- Looking Forward:
- Price - super high eff. PSUs are very new - time will bring cost deltas down , but not for free as advanced techniques and circuits required
- Titanium has very high and broad eff. (~94% over 10-90% load) this is not needed.
  - (80% eff. + light load efficiency would suffice) = less $
- Traditional PSU optimizations is focused on 20-90% loading.
  - Light load focus could produce more optimal eff. curves at light load
- Stability – need to work with PSU vendors to understand topology limitations requiring minimum loading
- Variability of light load implementations in production DT PSU's needs to be understood

PSU Light Load Eff.

- Light Load PSU Improvement Opportunities
  - Smaller transistors for reduced capacitance
    - Higher on resistance FETs Higher I^2 R losses
  - Magnetic / Capacitance improvements
    - Cost adders and may reduce Eff at other points.
  - *Reduced Operating Frequency @ light load
    - Complicates EMI emissions qualification
    - May prove problematic for pf correction in PSU's
  - *Pulse skipping Discontinuous Operation
    - Risk losing ability to handle load steps

* New Silicon likely needed requiring additional 9-18 mo. to implementation schedule

Next Steps

- Short Term 12-24 mo
  - Use existing PSU's on the market selecting good low load eff.
  - Transition to single output PSU (Common now but not pervasive)
- Medium Term 24-36 mo.
  - Low load optimization of existing PSU's using existing system architecture
    - Low load Eff. Optimization – may sacrifice high load Eff.
    - Implementation costs still being evaluated
- Long Term 36mo. Plus
  - Low load optimization of PSU's requiring silicon changes
    - Variable frequency / pulse skipping …
    - Evaluate Light load indication system to PSU
      - PSU redesign plus 6-9 mo min to evaluate opportunities for light load indication
    - Implementation costs still being evaluated
- Variability of light load efficiency in production may be significant
  - PSU losses become dominated by parameters insignificant in normal operation
  - Aggressive limits may drive significant yield loss driving up costs