

Recession Rewards for CMP Consumables

Techcet CMP Consumables 2011 Market Update

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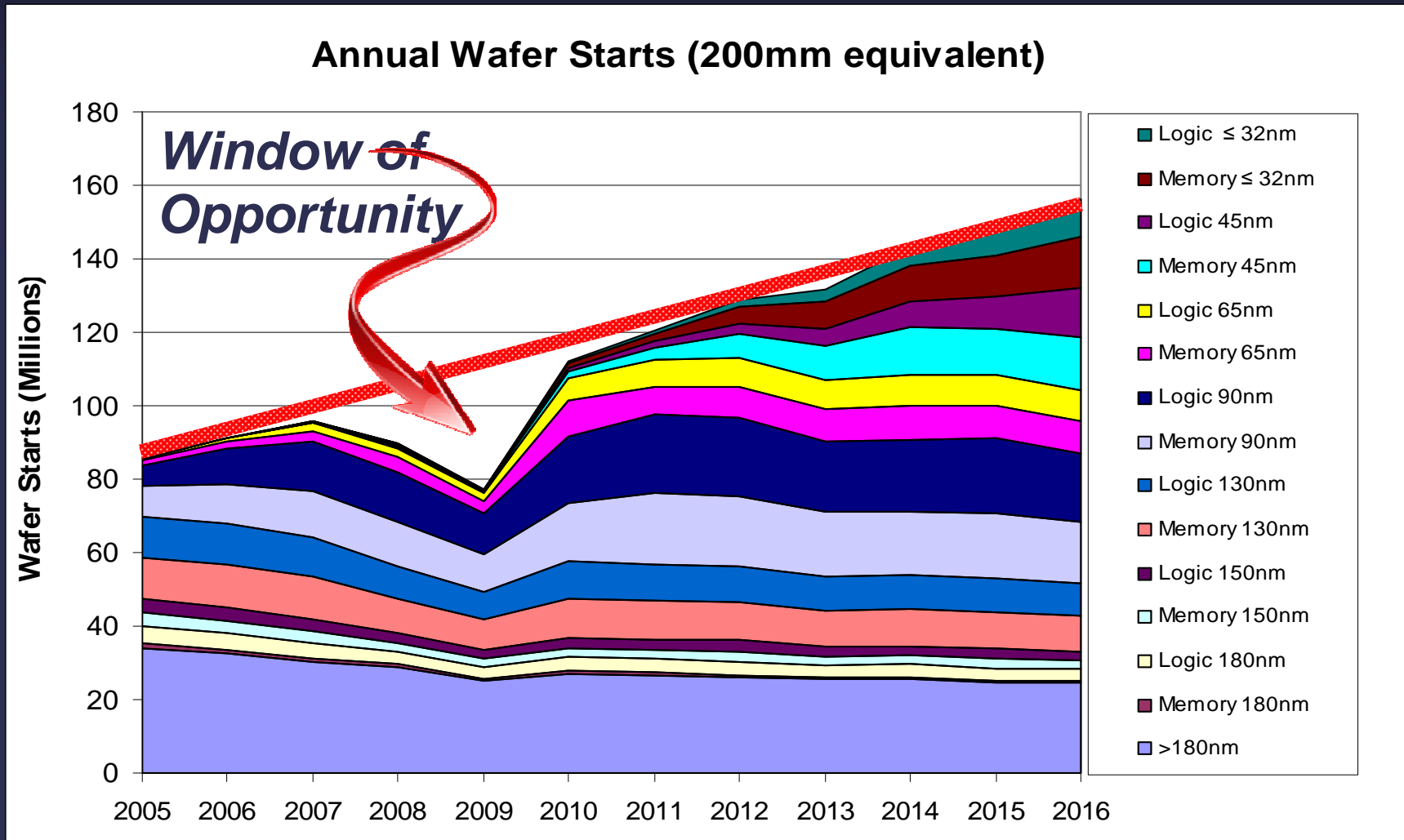
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Outline

- * The Window
- * The Results
 - ✦ Magic Triangles
 - ✦ Scratch That Itch
 - ✦ Flipper
- * The New, In With
- * The End

The Window

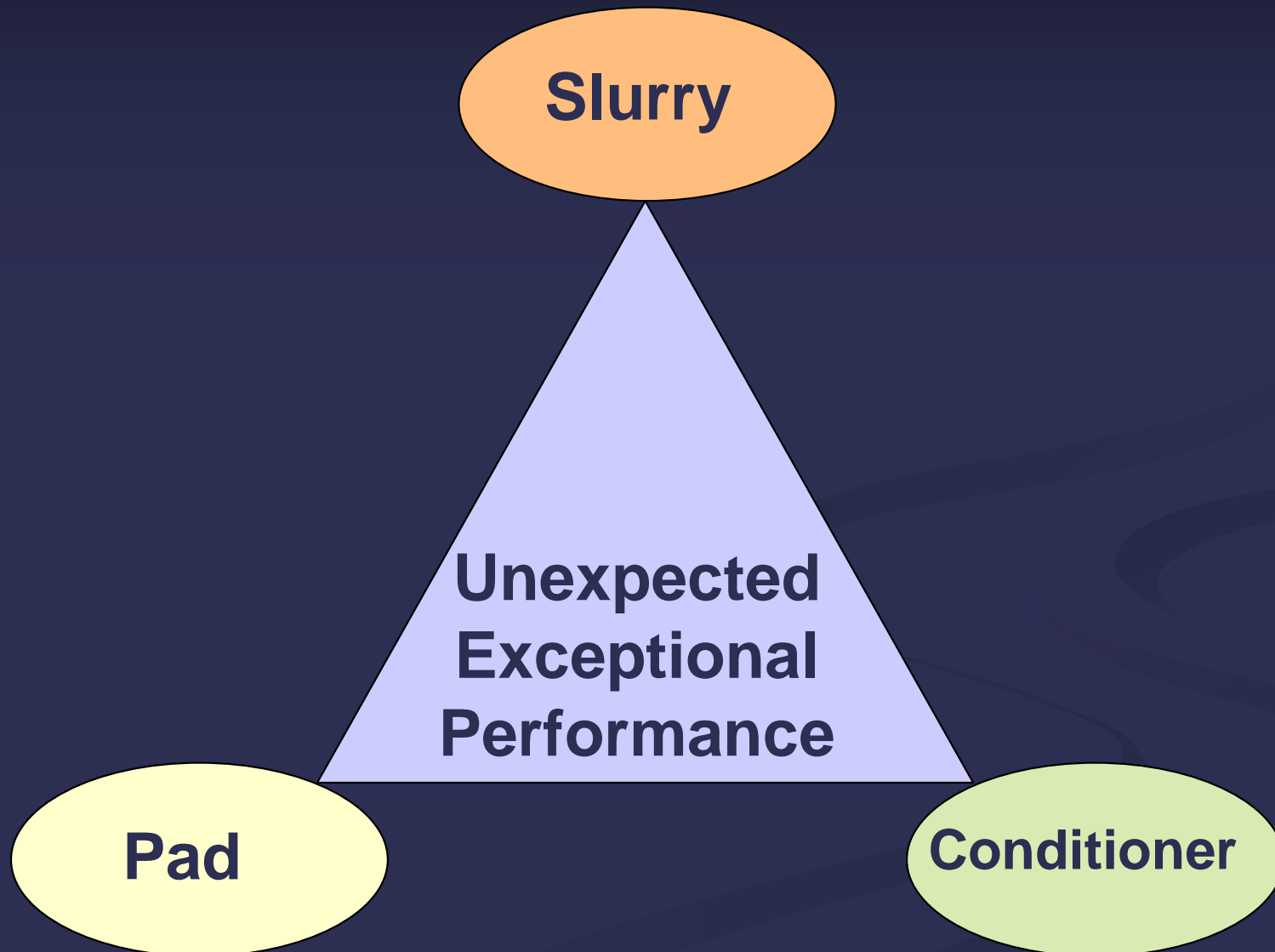


Source: Techcet Group, April 2011

The Window

- * Fabs in a Downturn
 - ✦ Clean, train, maintain
 - ✦ Develop new ways to reduce cost
 - ✦ Evaluate new products & methods
- * Cost reduction impacts incumbents
- * Evaluation time benefits insurgents
- * *Bonus motivation:* customer dissatisfaction with current supplier

Magic Triangles



Magic Triangles

* Why now?

- ✦ Years of talk about synergy between pad and slurry development produced *nothing*
- ✦ Crazy tight specs made us look more closely

* Systematic engineering work

- ✦ Designed experiments
- ✦ New products available for evaluation
- ✦ Fab tool time available
- ✦ Fab engineer work product, no R&D transfer

Magic Triangles

* Process characteristics

- ✦ Less aggressive pad conditioning
- ✦ Highly reproducible pad roughness
- ✦ Tight slurry PSD

* Resulting observations

- ✦ Sharp reduction in surface scratches
- ✦ Dishing meets aggressive specs
- ✦ Exceptional removal rate stability
- ✦ Lower CoO (pad life, conditioner life)

Magic Triangles

- * Specific examples: **CONFIDENTIAL**
 - † Patriot Act does not apply
 - † Enhanced interrogation techniques off limits
 - *Slurry-boarding on hold*

* Magic triangle citations

- † Cabot (pads)
- † Fujimi
- † Hitachi
- † innoPad
- † Intel
- † Morgan

Scratch That Itch

<i>Table FEP14 Shallow Trench Isolation CMP Process Technology Requirements</i>						
<i>Year of Production</i>	<i>2009</i>	<i>2010</i>	<i>2011</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>
<i>DRAM ½ Pitch (nm) (contacted)</i>	52	45	40	36	32	28
<i>MPU/ASIC Metal 1 (M1) ½ Pitch (nm)(contacted)</i>	54	45	38	32	27	24
<i>MPU Physical Gate Length (nm)</i>	29	27	24	22	20	18
<i>Wafer diameter (mm)</i>	300	300	300	300	300	450
<i>Wafer edge exclusion (mm)</i>	2	2	2	2	2	2
<i>Scratches</i>						
<i>Critical scratch length, s_c (nm) [A]</i>	25.8	22.5	20.0	17.9	15.9	14.2
<i>Critical scratch count, S_{pw} (#/wafer) [A]</i>	40.1	40.1	40.1	40.1	40.1	166.3
<i>Uniformity</i>						
<i>CMP total uniformity (3σ) for removal (%) [A]</i>	8	8	8	8	8	8
<i>CMP uniformity (3σ) within wafer (%) [A]</i>	6	6	6	6	6	6
				<i>Manufacturable solutions exist, and are being optimized</i>		
				<i>Manufacturable solutions are known</i>		
				<i>Interim solutions are known</i>		
				<i>Manufacturable solutions are NOT known</i>		

✳ Magic triangles will contribute to success

✦ Critical scratch length <20nm, <40/wafer

Source: 2010 Interconnect ITRS

Flipper

- * Old way

- ✦ Conditioner wears out, throw it away

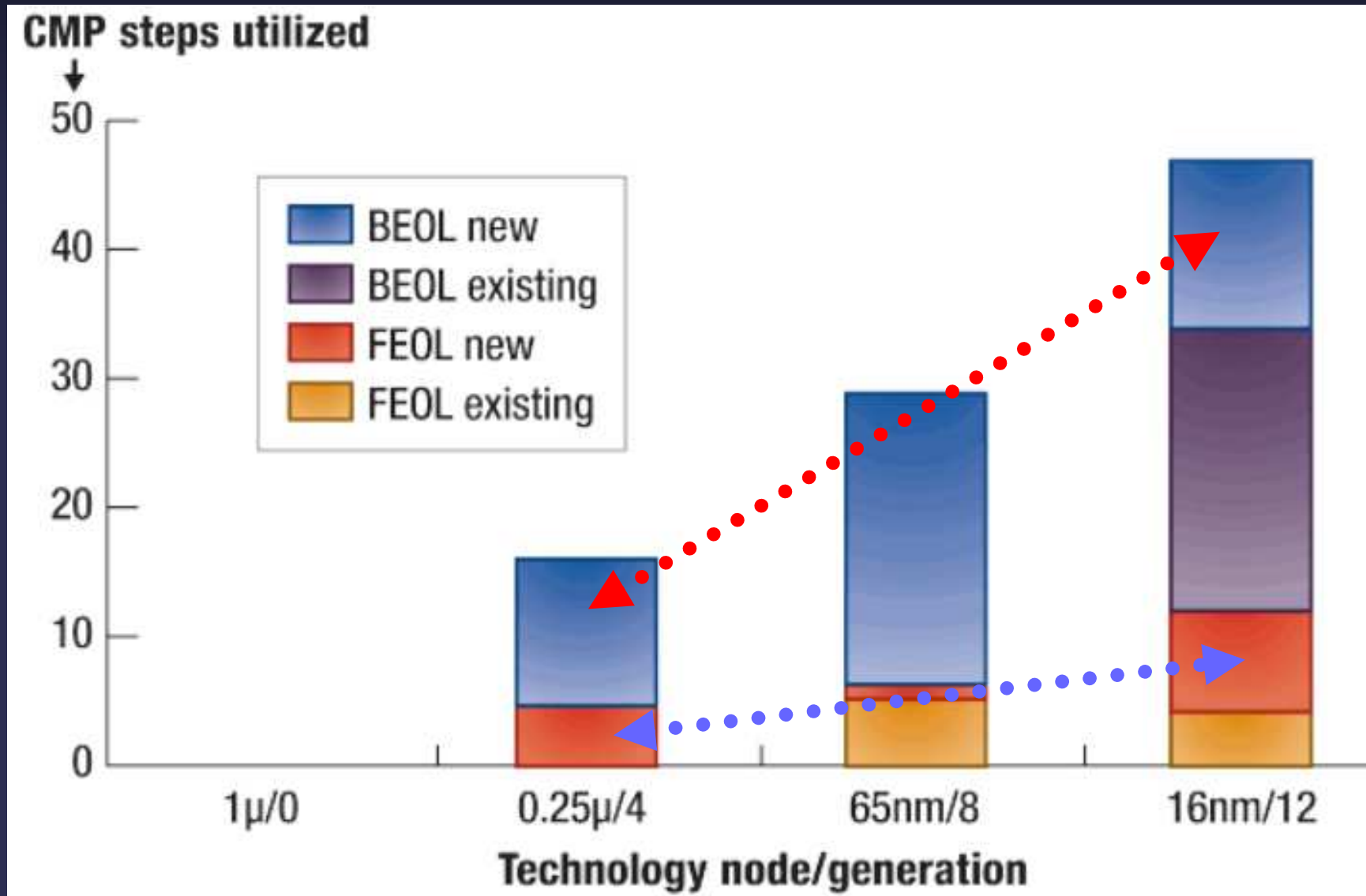
- * New way

- ✦ Conditioner wears out, turn it over

- * Saint-Gobain introduces Flipper

- ✦ Abrasive on both sides
- ✦ Reported CoO benefits 2.0x–2.5x

In With the New



Source: P. Feeney, Solid State Technology, November 2010

In With the New

- * Number of unique new CMP processes today is equivalent to total of all CMP steps at 0.25 μ m node
 - † Single step R&D cost same as multi-step interconnect process
 - † Unique by device type; few common to all
- * Recession rewards
 - † New collaborations, new personal relationships
 - † Startups gain traction and momentum

The End

- * Both CMP users and suppliers will benefit from work completed during the recession

Outlook from Semicon West 2010:

- * CMP recovery is ahead of expectations
 - ✦ CMP consumables revenue will surpass 2007 peak levels in 2010
 - ✦ No residual impact beyond 2010
- * Market Update at Semicon West 2011

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