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LESSONS FROM SUNEDISON:
Growth, Leverage, and Risk in Renewable Energy

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Abstract

SunEdison was once one of the fastest-growing renewable energy companies in the world, hailed as a pioneer in project development and financial innovation. However, it became one of the most notorious bankruptcies in the clean energy sector. This thesis examines the strategic decisions and financial mechanisms that shaped SunEdison's trajectory, linking corporate strategy to its financial outcomes. Through a combination of financial analysis, case comparison, and literature review, the work explores the multiple narratives that emerged around the company's collapse and seeks to identify the underlying causes behind its failure.

Keywords

SunEdison, Renewables, Energy, Finance, Strategy, Leverage, YieldCos, Semiconductor

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List of Abbreviations

CAGR: Compounding Annual Growth Rate

NOPLAT: Net Operating Profit/Loss After Tax

NWC: Net Working Capital

PPA: Power Purchase Agreement

IPO: Initial Public Offering

MW: Megawatt

GW: Gigawatt

USD: United States Dollar

DCF: Discounted Cash Flow

CAPEX: Capital Expenditure

YieldCo: Yield Company

PV: Photovoltaic

FiT: Feed-in-Tariff

1. Introduction

The evolution of MEMC/SunEdison can be broadly divided into three distinct phases. The first phase refers to the period prior to the acquisition of SunEdison, when MEMC operated primarily as an upstream supplier of polysilicon and silicon wafers to the semiconductor and solar industries. The second phase begins with the acquisition and integration of SunEdison in 2009, marking a strategic shift toward renewable energy and the initial steps toward vertical integration. The third phase, during which the company is fully focused on its downstream activities, solar project development and energy services. These phases offer a structured lens through which to analyze the company's strategic trajectory, financial performance, market reactions, and the narratives that shaped its positioning over time.

Founded in 1959 as Monsanto Electronic Materials Company, MEMC pioneered wafer technologies and expanded globally. By the late 2000s, MEMC was producing polysilicon and silicon wafers, supplying both the semiconductor and solar industries, and positioning itself firmly in the upstream segment of the semiconductor value chain.

Throughout its history, MEMC consistently sought to reinvent itself in response to structural and market challenges. Its gradual diversification into photovoltaic wafers reflected an effort to capture growth opportunities in the emerging solar market, even as its core operations remained rooted in polysilicon and wafer manufacturing.

In 2009, through the acquisition of SunEdison, the company aimed to bridge its upstream manufacturing base with downstream project development activities. This move marked the beginning of a new strategic phase, aimed at building a vertically integrated renewable energy company. However, as competitive pressures intensified, MEMC, by then rebranded as SunEdison, shifted its focus entirely toward project development and energy services from 2014 onwards.

Ultimately, the company's operational inefficiencies, strategic missteps, and tightening financial conditions culminated in SunEdison's bankruptcy filing in 2016.

2. Before 2009: "The good times at MEMC won't last forever." (Morningstar, 2008[1])

2.1. Semiconductor Market before 2009

"A temporary supply shortage in the wafer market has boosted MEMC's profitability in the past several years. However, we do not expect current business conditions to last" *(Morningstar, 2008)*

As an upstream supplier, MEMC was inherently vulnerable to external factors shaping its end-markets. Its performance depended heavily on the cyclical dynamics of the semiconductor, solar, and wafer industries.

Between 2000 and 2007, the semiconductor industry expanded steadily, reaching $239.8 billion in 2007, fueled by strong global demand for consumer electronics, computers, telecommunications equipment, and automotive applications. However, the 2008 financial crisis abruptly reversed this trend: demand for electronics contracted, inventories surged, and capital spending slowed, leading to a decline of –3.8% in 2008 and a sharper fall of –20.7% in 2009, with global revenues dropping to $182.9 billion. This highlighted the industry's extreme cyclicality, further intensified by the "bullwhip effect": even modest declines in end-user demand during 2008 translated into disproportionately sharp revenue swings for upstream suppliers like MEMC. Geographically, production became increasingly concentrated in the Asia-Pacific region, mainly driven by lower labor, lower electricity costs, tax incentives and the region's well-developed industrial infrastructure. In 2009, more than 75% of global semiconductor production was concentrated in Asian countries, while the United States and the European Union together recorded the highest combined loss of market share (–9%), according to EECA-ESIA and WSTS data (European Commission, 2012).

On the other hand, the solar wafer market expanded rapidly in the mid-2000s, supported by strong growth in photovoltaic installations, government subsidies and high fossil fuel prices. Global renewable energy revenues grew at a compound annual rate of 13.4% between 2004 and 2008, reaching $310.5 billion in 2008. In 2009, the supply of solar-grade polysilicon was still concentrated in the United States, Germany, Japan, and increasingly Korea, with Hemlock, REC, and MEMC together accounting for about 94% of US production, of which 90% was exported (IEA, 2009).

[1] Morningstar. (2008). MEMC Electronic Materials, Inc. (WFR) Equity Report.

Additionally, another critical input in MEMC's operation is Polysilicon, the ultra-pure form of silicon used as feedstock for wafer manufacturing, as the company was both a wafer supplier and a polysilicon producer at its US facilities (MEMC, 2009 Annual Report). At first, polysilicon represented a critical raw material for MEMC, as the company primarily operated as a wafer manufacturer purchasing this input on the market. However, in 2006, MEMC shifted its strategy toward vertical integration by establishing its own polysilicon production facilities in Pasadena (Texas) and Merano (Italy). By producing and partially selling polysilicon during the 2007-2008 price spike, MEMC benefited from the temporary market shortage.

According to Bernreuter Research (2018), polysilicon prices experienced cyclical shortages and oversupply periods, with the 2006–2008 spike marking the sharpest historical peak. After reaching extreme highs of around $360/kg in 2008 due to temporary shortages, polysilicon prices collapsed to nearly $80/kg in early 2009 and $56/kg by 2011[2]. This sharp decline resulted from a confluence of structural and macroeconomic factors: the 2008 global financial crisis curtailed investment in solar and electronics markets, major European economies reduced feed-in tariff subsidies, and a massive wave of new, low-cost Chinese entrants (such as GCL-Poly, Daqo, and Renesola) flooded the market with excess capacity supported by government incentives and cheap energy.

2009 Annual Reports consistently warned that profitability was highly sensitive to polysilicon and wafer price swings, emphasizing the risks inherent to long-term supply contracts. Rising prices could force MEMC to sell below market levels, while falling prices strengthened customers' bargaining power to renegotiate or default, illustrating the company's fragile position within highly cyclical end markets (MEMC, 2008–2009 Annual Reports).

As highlighted in Morningstar's August 2008 report, MEMC's upstream positioning exposed it heavily to fluctuations in polysilicon and wafer prices. At the time, the company's profitability was largely driven by exceptionally high wafer and polysilicon prices rather than by structural cost advantages or superior operational efficiency. Meanwhile, new competitors, particularly in Asia, were rapidly entering the market with more efficient production technologies and lower cost structures. The following years were therefore expected to bring significant uncertainty, with growing concerns that MEMC's margins could narrow as market conditions normalized, which ultimately materialized.

[2] Bernreuter Research. (2018). Polysilicon Price Trend. Bernreuter Research – Polysilicon Market Reports.

2.2. Financial overview of MEMC until 2009

"*Silicon prices are set to collapse in the second half of 2008 and MEMC's ability to maintain market share and margin profile will be increasingly difficult*" *(RBC Capital, 2007[3])*

Between 2002 and 2009, MEMC's semiconductor segment underwent a remarkable operational transformation marked by a sharp recovery in returns, margins, and cash generation before the 2008 global downturn. The firm had narrowly avoided bankruptcy during the 2001 industry downturn. Its survival depended on a rescue that year, when private-equity firm Texas Pacific Group acquired a controlling 72% stake, enabling a major financial restructuring and a renewed strategic focus. However, this recovery also underscored MEMC's strong dependence on market price dynamics. In April 2007, RBC Capital Markets warned that the polysilicon shortage driving MEMC's growth could soon shift to oversupply, recommending that investors took profits off the table as maintaining market share and margins would likely become increasingly difficult.

Following the severe losses of 2001–2002, when Operating ROIC stood at –36% and –2% and NOPLAT was deeply negative (–519M$ and –5M$), the company embarked on a manufacturing restructuring program, closing unprofitable lines and cutting fixed costs. According to the MEMC's 2003 Annual Report, "During 2001, we recorded restructuring costs totaling $32.5 million to close our small diameter wafer line at MEMC Southwest Inc. in Sherman, Texas, and to reduce our workforce by approximately 2,300 employees." These actions led to a systematic reduction in operating costs and helped restore the segment's profitability. Additionally, the global polysilicon shortage between 2003 and 2008 pushed wafer prices to record highs, allowing the company to achieve exceptional results. Operating ROIC reached 52% in 2006, peaked at 95% in 2007, and remained solid at 30% in 2008, while operating margins grew from 18% in 2003 to 43% in 2008. NOPLAT rose from $117 million in 2003 to $827 million in 2007. This improvement was also reflected in the company's cash generation: Free Cash Flow to the Firm increased from almost $0 in 2002 to $344 million in 2006 and $660 million in 2007, confirming that higher profitability effectively translated into stronger operating cash flows and internal funding capacity.

Early signs of deterioration appeared in 2008. Compared with 2007, recurrent NOPLAT decreased from $827 million to $635 million, Operating ROIC fell from 95% to 30%, and FCFF

[3] Barron's Tech Trader Daily (2007), Stuart Bush (RBC Capital Analyst).

declined from $660 million to $130 million. The downturn reflected softer demand and rising working capital needs, as inventories and receivables increased amid the first signs of a slowdown in semiconductor orders. Meanwhile, CAPEX remained high at $283 million in 2008, compared with $224 million in 2006, as the company continued its investment program launched during the expansion cycle.

MEMC's COGS-to-sales ratio declined steadily from 66% in 2003 to 44% in 2007, before rising sharply to 78% in 2009. Comparing the evolution of silicon prices with this margin trend clearly reveals the company's cyclical exposure to commodity-driven market dynamics. The profitability boom between 2005 and 2008 was primarily driven by exceptionally high polysilicon prices rather than by structural efficiency improvements. Once prices normalized and wafer competition intensified, MEMC's rigid cost base led to a rapid deterioration in margins from 2009 onwards (exhibit 1).

Operating ROIC dropped to –5%, recurrent NOPLAT fell to –$68 million, and operating margins declined to –8%. Despite weaker performance, CAPEX rose again to $662 million, nearly three times higher than in 2006, reflecting ongoing capacity expansion and technology upgrade projects initiated in previous years. As a result, FCF fell to –$959 million, illustrating the combined effect of lower profitability, reduced pricing power, and sustained investment outlays.

2.3. Competitive Landscape

Since MEMC's business model until 2009 remained fully upstream, focusing on polysilicon and silicon wafers, the most relevant comparable were other global wafer producers, namely SUMCO and Shin-Etsu, whose performance in that year provides a direct benchmark to assess MEMC's relative positioning.

Both polysilicon and wafer prices declined sharply in 2009: polysilicon mainly due to oversupply after massive capacity expansion in China, and wafers mainly following the drop in semiconductor and solar demand.

MEMC's temporary operating margins were primarily driven by extraordinary polysilicon prices rather than by structural efficiency. Unlike its Japanese peers, MEMC was vertically integrated and produced polysilicon internally, selling part of it on the spot market during the 2005–2008 price surge that provided a short-term revenue boost. In 2009, as market conditions

deteriorated, MEMC reported revenues of $1.2 billion with an operating margin of –8.5%, while SUMCO generated approximately $3.2 billion in sales with an operating margin of 3.9%, and Shin-Etsu's semiconductor materials division achieved around $4.7 billion in revenues and an operating margin of 15.9% (exhibit 2). Although all major producers were negatively affected by the downturn, MEMC's profitability suffered the most, as its heavier cost structure and exposure to spot-market volatility amplified the impact of the price collapse.

Equity betas were estimated using weekly returns from 2006 to 2008, covering both the peak of the semiconductor cycle and the beginning of the 2008 downturn. Weekly data provides a good balance between reducing short-term noise and ensuring enough observations for reliable estimation. Betas were calculated through a standard OLS regression of company returns against a broad market index. The results show betas unlevered of approximately 1,28 for MEMC, 0,77 for SUMCO, and 0,86 for Shin-Etsu. The lower unlevered betas of SUMCO and Shin-Etsu are consistent with their more predictable cash flows, resulting from efficient cost structures and long-term customer contracts. In contrast, MEMC's exposure to the spot polysilicon market and its less efficient, higher-cost structure make its cash flow significantly more cyclical and uncertain.

MEMC's competitive position going into 2009 was structurally weaker than that of its Asian peers, largely due to geography and cost base. Most of MEMC's key manufacturing assets were in the United States and Europe, including wafer and polysilicon production in Missouri and Texas (US), plus additional capacity in Italy and Scotland, which implied higher operating costs. By contrast, Shin-Etsu Handotai and SUMCO concentrated production in Japan and complemented that capacity with plants in lower-cost Asian locations, including Malaysia (for Shin-Etsu) and Taiwan via Taisil (for SUMCO).

This geographical asymmetry translated directly into cost differentials: in the late 2000s, average hourly manufacturing compensation was roughly 32 $in the United States, about 23 $in Japan, around 17$ in South Korea, and below 5$ in Malaysia (U.S. Bureau of Labor Statistics, 2010). Industrial electricity prices were also significantly higher in the United States and Europe than in Asia, approximately 0.11 USD/kWh compared with 0.06 USD/kWh in South Korea and 0.07 USD/kWh in Malaysia (IEA, 2009). Lower labor and energy costs in Asian manufacturing hubs gave local producers a structural advantage. In addition, governments actively supported high-tech manufacturing through tax and infrastructure incentives. Korea's Free Economic Zone program, launched in 2003, offered multi-year

corporate tax reductions and subsidized utilities, while Malaysia's Pioneer Status and Investment Tax Allowance schemes (introduced in 2007) granted income tax exemptions to foreign manufacturers. These measures helped Asian competitors sustain production and protect market share even as global wafer prices collapsed (MOTIE, 2003; MIDA, 2007).

MEMC, by contrast, carried a heavier fixed cost base and less flexibility: when demand contracted after 2008, it dropped from fourth to fifth place globally, despite the overall market shrinking, while LG Siltron and Japanese suppliers held or gained relative position (Gartner, 2010). MEMC operated energy-intensive polysilicon plants that required continuous operation at high temperatures, making shutdowns technically risky and economically prohibitive. As a result, the company was forced to keep these costly facilities running in high-cost regions even as demand and prices fell, deepening its competitive disadvantage

MEMC's decision to maintain production in the United States and Europe was initially consistent with its quality-driven positioning, ensuring process control and proximity to long-standing semiconductor clients, this advantage eroded as the industry shifted eastward. By 2008, more than 60% of global photovoltaic and semiconductor manufacturing capacity was already concentrated in Asia, led by Japan, China, and South Korea (IEA, 2009). As a result, regional cost competition intensified and the premium once associated with US and European wafer producers largely disappeared: "The shift of semiconductor and solar manufacturing to Asia intensified cost competition and reduced the premium previously associated with US and European wafer producers" (Gartner, 2010). Between 2005 and 2010, several of MEMC's key semiconductor clients relocated manufacturing capacity from the United States and Europe to Asia. Intel opened a $2.5 billion wafer factory in Dalian, China (Intel, 2007), Infineon built a new facility in Kulim, Malaysia (Infineon, 2008), and STMicroelectronics shifted operations from the US to Asia (STMicro, 2008). As a result, proximity to customers, once a strategic advantage for MEMC's Western facilities, lost relevance, while Asian wafer suppliers benefited from being closer to these expanding manufacturing hubs (IEA, 2009; Gartner, 2010).

MEMC's pre-2009 success relied on exceptional polysilicon price spikes, not on competitive strength. With a rigid, high-cost base and rising exposure to commodity volatility, MEMC was poorly positioned to withstand the post-2008 downturn and in need of a strategic shift to ensure long-term resilience. As Asian competitors expanded with lower costs and silicon prices collapse, the company's brief period of prosperity quickly faded, confirming Morningstar's warning that "the good times at MEMC won't last forever."

3. 2009-2013: Period of Change and Realignment

3.1. Strategic Rationale Behind the SunEdison Acquisition in 2009

By the late 2000s, renewable energy had emerged as one of the fastest-growing global sectors, supported by government subsidies, rising fossil fuel prices, and the acceleration of photovoltaic (PV) installations. Renewable energy deployment at the time was largely policy-driven: in Europe, feed-in tariffs guaranteed above-market electricity prices for 15–20 years in countries such as Germany, Spain and Italy, while in the United States the federal Investment Tax Credit (30% of project costs, extended in 2008 until 2016) and the Production Tax Credit for wind provided long-term fiscal support (IEA, 2009; United States DOE, 2009).

Within this context and considering wafers efficiency' challenge faced by the company, the acquisition of SunEdison represented a strategic turning point: it provided MEMC with direct entry into the downstream solar project development business, securing captive demand for its wafers while opening a pathway to capture higher and more stable value across the solar value chain. MEMC's move downstream through SunEdison was not only a defensive response to wafer market volatility, but also a proactive strategy to align with the structural growth of renewables underpinned by stable, incentive-backed revenue streams.

Before acquisition in 2009, SunEdison was a startup pioneered the solar PPA model in the United States, with early projects such as rooftop installations for Whole Foods Market in the mid-2000s. Although the company had only about 80 MW operational by 2009, its 1.3 GW pipeline and expertise in structuring long-term contracts made it a strategic platform for MEMC's downstream integration. MEMC acquired SunEdison in 2009 for approximately $200 million, including debt assumption. A key element of the transaction was the integration of SunEdison's development teams, whose expertise in structuring PPAs and managing distributed projects was as strategic as the pipeline itself, providing MEMC with capabilities it did not previously possess. Even though solar project development requires significant upfront CAPEX, long-term PPAs transform these investments into bankable assets by providing predictable cash flows and facilitating project finance.

3.2. Financial Overview 2009-2013

From 2009 onwards, MEMCs/SunEdison reported revenues separately for three segments: Semiconductor Materials, focused on producing silicon wafers for the semiconductor industry, Solar Materials, which comprised the manufacturing and sale of solar-grade silicon wafers and

Solar Energy, which included the development, financing, construction, and operation of solar power systems. SunEdison generally sold its solar parks in Europe, Asia, and Canada to investors after construction was completed. In contrast, in the United States, the company often used sale-leaseback financing structures or sold the systems directly to strategic buyers, which allowed it to recognize revenue from electricity generation.

MEMC/SunEdison's pipeline growth was largely acquisition-driven. In 2009, the company entered Europe through the purchase of BISS (Germany), adding 38 MW of projects and access to 300 MW of opportunities in Italy and Spain. The most significant expansion came in 2011 with the acquisition of FRV (Fotowatio Renewable Ventures), which contributed 1.4 GW of development projects across Spain, the United States and Latin America. In that same year, Axio Power added 500 MW of United States projects.

Between 2009 and 2012, SunEdison's total revenues increased from $1,163.6 million to $2,529 million. The Semiconductor Materials segment, focused on silicon wafers for the electronics industry, increased from $586.3 million in 2009 to $1,023.1 million in 2011 and then slightly declined to $917.5 million in 2012 (Exhibit 3).

Solar Energy grew from $3.8 million in 2009 to $735 million in 2011 and Solar Materials had grown from $573 million to $957 million over the same period. In 2012, although Solar Energy and Materials revenues were reported together and reached $1,612 million, the company noted that "the decrease (…) from 2011 to 2012 reflects declines in solar wafer sales of $497.5 million", indicating that a significant drop was attributable to the former Solar Materials segment, and partially offset by solar energy growth.

Operating cash flow remained positive during 2010–2012, ranging from $49M and $212M, but was modest relative to capital expenditures fluctuating from $600M and $1.178M. In 2013, SunEdison's payables reached 199 days, which temporarily improved the company's cash position, as suppliers effectively financed operations. However, this reliance on extended payment terms was unsustainable in the long run and reflected structural weakness in working capital management. This approach contributed to a positive variation in working capital during 2013, supporting free cash flow.

In 2013, OCF declined to -$35M, reflecting lower project sales and compressed margins. Gross margin fell to approximately 20,6%, while operating margin dropped to -16,2%, indicating limited profitability despite scale.

SunEdison transitioned from a net cash position in 2010 to $1.8 billion in net debt by 2012, and further to approximately $3 billion in 2013, significantly increasing financial leverage and balance sheet risk. This escalation was accompanied by a 70% CAGR in interest expenses, compressing interest coverage ratios and reducing financial flexibility. Additionally, the decline in current ratio to 0,93 underscores short-term solvency challenges.

Given the declining performance of its wafer businesses, both in the semiconductor and solar segments, the company decided to shift its strategic focus entirely downstream, concentrating on project development and energy generation. During this phase, SunEdison divested its semiconductor division and discontinued external sales of solar wafers, redirecting resources toward the integrated development, financing, and operation of solar power systems. As part of this transition, SunEdison retained more projects on the balance sheet, increasing assets held for sale and reducing immediate monetization, as preparation for the proposed YieldCo IPO.

Additionally, the company shifted its sales mix from fully developed projects (95% of solar revenue in 2012) to EPC contracts (from 5% to 25% in 2013). This transition was driven by liquidity purposes, as EPC projects required significantly lower cash outlays than fully developed projects, reducing upfront capital intensity while enabling SunEdison to maintain market presence. According to the annual report, this shift led to a reduction of approximately $0.43 per watt in the average selling price.

Consequently, solar segment revenue declined to $2,008 million in 2013, compared to $2,530 million in 2012, as the company retained more projects on the balance sheet and

3.3. Perception versus Reality: How Investors Misjudged MEMC's Transition

a) ***"Piper Jaffray analyst warned that investors were concerned MEMC's "strong balance sheet" could be dragged down by the need to finance SunEdison's large-scale, lower-margin solar projects, and that management still had to convince the market of the strategy."*** *(The Street, 2010)*

The concerns raised by Piper Jaffray in 2010 misidentified the main source of risk. Between 2004 and 2008, MEMC did indeed display a strong balance sheet, characterized by solid equity, easy access to bank financing, and a steadily improving operating margin that peaked at 55% in 2008. However, a strong balance sheet is a backward-looking indicator: it represents the accumulation of past performance, not a guarantee that future investments will generate returns.

Investment decisions must be forward-looking, based on the company's ability to sustain future cash flow rather than on historical profitability.

Between 2010 and 2012, SunEdison's total revenue increased by 4%, driven by a 9% growth in solar sales, while semiconductor revenue declined by 4%. The semiconductor segment's operating margin collapsed by 21 percentage points in 2009, revealing the company's lack of structural efficiency and confirming that previous profitability had been largely price-driven. The company's heavy cost structure made it less competitive and less adaptable to market downturns, meaning that in periods of heightened competition, more efficient producers were better positioned to preserve margins and capture market share. This sharp deterioration signaled that future cash flows would remain highly dependent on market prices, undermining the solidity of MEMC's forward-looking position.

Contrary to the concerns expressed by Piper Jaffray, the company's financial vulnerability did not stem from financing SunEdison's downstream solar projects, but from its inefficient and capital-intensive upstream structure (wafers).

Polysilicon, the primary raw material used in solar wafer production, was both manufactured and processed internally by the company. In solar segment, MEMC initially believed that controlling these upstream components would reduce costs and create a competitive advantage. However, by 2011, the global price of solar energy had dropped sharply due to increased competition and economies of scale. The average price of solar panels declined from $5.5/W to $0.9/W in 2011 (IEA,2014), eroding the profitability of capital-intensive upstream operations.

In this context, and consistent with the decline in solar materials sales previously discussed (-$497,5 Million from 2011 to 2012), the company stated in its 2013 Annual Report that "solar wafer sales to external parties are expected to be a smaller component of our business in comparison to historical levels given our strategic shift to primarily supplying wafers for internal consumption." MEMC subsequently closed several high-cost polysilicon facilities, culminating in the indefinite shutdown of the Merano (Italy) plant in 2014, after management acknowledged that "identified cost reductions were not enough to sustain the economic viability of the plant in the current market environment."

To conclude, the evidence suggests that MEMC's balance sheet strength in 2008 reflected temporary price conditions rather than operational superiority. The company's real fragility lay

in its inefficient upstream cost structure, not in the expansion of SunEdison's downstream projects. The attempt to redeploy this temporary advantage into the solar segment only exposed the structural rigidity of its semiconductor business, confirming that in 2009 the company's challenges were rooted in its core operations related to wafers.

b) ***"This vertical integration is designed to afford several advantages to the company. First, having a silicon manufacturing segment lowers procurement costs at the project level and gives SunEdison better visibility into quality."*** *(Harvard Business School[4])*

The assumption that SunEdison's vertical integration would lower procurement costs and enhance quality control proved inaccurate when tested in practice.

Between 2009 and 2013, the three main US solar companies pursuing vertical integration followed markedly different strategic and financial trajectories.

First Solar, which combined in-house thin-film module manufacturing with selective downstream project development, increased revenues from $2.1 billion in 2009 to $3.3 billion in 2013, a compound annual growth rate of 11.8%, while maintaining one of the strongest operating margins in the sector, averaging around 17–20% (First Solar 10-K 2013). First Solar specialized in thin-film photovoltaic modules based on cadmium telluride, an alternative technology that, at the time, provided a cost-competitive advantage due to lower material and manufacturing expenses compared to conventional silicon-based solar cells.

SunPower, producer of high-efficiency crystalline modules and integrated systems, expanded from $1.5 billion to $2.5 billion (CAGR 13.6%) with operating margins improving from –4% to +6% (SunPower 10-K 2013). During this period, the company acquired and operated several large-scale manufacturing facilities outside the United States, notably in Malaysia, the Philippines, Mexico, and China, which enabled it to progressively optimize production costs.

SunEdison (formerly MEMC), in contrast, pursued a full-chain integration model combining upstream wafer production with project development, revenues rose from about $1.2 billion in 2009 to $2.0 billion in 2013 (CAGR 13.0%), while operating margins remained close to breakeven (MEMC/SunEdison 10-K 2013).

[4] Harvard Business School, SunEdison: Solar as a Service – The YieldCo Model, 2015

The comparison shows that vertical integration created sustainable value only when supported by cost efficiency and technological advantage: First Solar and SunPower achieved both, whereas SunEdison's high-cost manufacturing base and lack of flexibility prevented operational leverage from translating into profitability.

In practice, MEMC's upstream production costs remained higher than those of external suppliers, meaning that internal sourcing did not lower procurement costs as intended. Moreover, the expected quality advantage from vertical integration proved immaterial in a market where rapid technological progress and scale efficiencies set the pace for competitiveness. Instead of gaining flexibility and cost control, SunEdison inherited the rigidity of MEMC's manufacturing base, a structure too expensive to sustain and too slow to adapt.

Analysts initially misjudged MEMC's transformation, perceiving the expansion into solar development as the main source of risk while overlooking the deeper structural weaknesses inherited from its semiconductor roots. Between 2009 and 2012, the company was simultaneously operating two highly capital-intensive business models, semiconductor wafers and solar project development, both facing intensifying competition and growing pressure to achieve cost efficiency. This dual exposure strained financial resources and limited the company's ability to remain competitive in either segment. Vertical integration, intended to secure cost control and quality advantages, instead amplified financial pressure and reduced flexibility. By 2013, SunEdison's operating cash flow had turned negative, while net debt had escalated to approximately $3 billion, underscoring that the company's strategic direction was not delivering the intended results.

4. 2013 Onwards: A Full Commitment to Solar

4.1. Contextual Foundations for Analysis: SunEdison's Strategy Shift

Understanding SunEdison's 2013–2014 context is essential to interpreting the narratives that emerged during the company's rise. In June 2015, the company reached its peak share price of $32.10, only to collapse to $0.34 by April 2016. (exhibit 4)

From 2013 onwards, SunEdison underwent a profound strategic transformation, shifting its core business from semiconductor manufacturing to renewable energy development. This transition was driven both by deteriorating margins in its legacy wafer segment and by management's ambition to reposition the company as a fully integrated clean-energy developer.

Initially, capital markets rewarded this strategy. TerraForm Power's IPO was oversubscribed, and its share price surged as investors embraced the promise of 12–15% annual dividend growth. To sustain dividends and justify high valuations, YieldCos required a constant flow of new assets from SunEdison.

Between 2014 and 2015, SunEdison spent over $6 billion on acquisitions, including First Wind, Invenergy, and several smaller developers across the United States, India, and Latin America. These transactions, widely viewed as overpriced, inflated the company's asset base without generating expected cashflows. Furthermore, by late 2015, SunEdison's project pipeline exceeded 8 GW, of which 6 GW remained under development or construction. The company's liquidity was increasingly tied up in unfinished assets.

To sustain this cycle, SunEdison increasingly relied on short-term corporate and bridge financing, expecting to refinance debt once projects were sold to its YieldCos. This structure blurred the boundaries between the parent company and its subsidiaries: SunEdison decided which assets to transfer, at what price, and when. Incentive Distribution Rights further distorted governance by allowing SunEdison to capture a rising share of YieldCo dividends as payouts increased, reinforcing short-term growth targets at the expense of long-term financial stability.

The collapse in YieldCo valuations during the second half of 2015, due to tighter monetary policy and investor confidence erosion, cut off SunEdison's access to the cheap financing.

By late 2015, SunEdison's liquidity position had become critically constrained: although the company reported $1.4 billion in cash, more than half was restricted to project-level accounts, leaving less than $400 million freely available at the corporate level. At the same time, short-term debt maturities exceeded $1.9 billion. approximately 16% of the company's

$11.7 billion total debt, highlighting a severe liquidity mismatch between near-term obligations and illiquid development-stage assets.

Unable to refinance its growing debt or monetize its extensive portfolio of development-stage, SunEdison collapsed into bankruptcy in April 2016.

4.2. Perception versus Reality: How Investors Misjudged SunEdison

a) "SunEdison's agreement to buy Vivint Solar was the beginning of the end." *(Bloomberg, "SunEdison's Downfall: From Wall Street Darling to Bankruptcy,")*

To fully understand this statement, it is essential to examine the evolution of SunEdison's project pipeline over the two years preceding the Vivint Solar acquisition.

In 2024, operational assets held by TerraForm Power totaled 531 MW originating from previous SunEdison projects and acquisitions, along with 456 MW from new purchases. (exhibit 5) The company invested $723 million to acquire 123 MW of distributed generation assets valued at $310 million, and an additional 332 MW of utility-scale solar assets costing $412 million. The acquisition cost per megawatt for distributed generation solar projects was approximately $2.5 million, compared to $1.4 million per MW for utility-scale solar.

In 2015, SunEdison acquired First Wind for $2.4 billion, securing 2.1 GW of wind assets in operation and under construction, along with a substantial development pipeline. The deal included an additional $500 million in milestone payments, contingent upon the successful delivery of development projects. As part of the transaction, TerraForm Power purchased 521 MW of operating assets for $862 million (equivalent to about $1.65 million per MW), while the remaining $1.04 billion corresponded primarily to 2.1 GW of development-stage projects, valued at roughly $130,000 per MW (only considering upfront payments). Although this latter valuation fell within the industry's indicative range for early-stage projects ($100,000–300,000 per MW), such assets carried far greater uncertainty related to permitting, financing, and construction, making their ultimate cash-flow realization highly dependent on execution success.

To estimate the intrinsic value of the First Wind portfolio acquired by TerraForm Power, project-level cash flows were derived from the contractual terms of each Power Purchase Agreement, incorporating expected annual revenues based on contracted prices, load factors, and reported operation and maintenance (O&M) costs, according to each project's

region. These cash flows were discounted using a rate of approximately 8.2%, consistent with market averages for contracted renewable assets in the United States during 2014-2015[5]. For residual value, it was assumed to be a useful life of 25 years for wind farms and 30 years for solar parks[6]. After the expiration of PPAs, revenues were projected to decline to around 60% of the original PPAs levels, reflecting competitive pressures in merchant markets.[7] Under these assumptions, the simplified discounted cash flow analysis resulted in approximately $864 million, compared with TerraForm Power's acquisition price of $862 million. Notably, Hawaii accounted for 38% of the portfolio's value while representing only 10% of its installed capacity, driven by above-average energy prices, which made the portfolio highly attractive. Therefore, an approximate cost of $1.65 million per MW can be considered aligned with market expectations. (exhibit 6)

In July 2015, SunEdison acquired 930 MW of wind capacity from Invenergy for approximately $2 billion, corresponding to around $2.15 million per megawatt. It was above the 2015 United States industry average of $1.69 million per MW for installed wind capacity, as well as above First Wind $/MW estimate, where fairly value reached was very close to $1.65 million per MW. The timing of the Invenergy acquisition marked a turning point in investor sentiment, as it raised serious questions about TerraForm Power's independence and whether the assets being acquired were truly beneficial to its shareholders. In a letter to TerraForm Power's board, Appaloosa Management LP stated that "a strategic focus aligned around acquiring projects from SunEdison offers little apparent benefit for the stockholders of TerraForm Power and raises concern for obvious conflicts between the interests of the two parties."[8]

In 2015, the attempted $2.2 billion acquisition of Vivint Solar ultimately failed but exemplified SunEdison's strategic overstretch. The deal would have added approximately 523 MW of residential rooftop capacity already in operation and a 4 GW development pipeline, within a segment structurally less efficient and less valued by investors than utility-scale solar. Residential rooftop projects were inherently fragmented, with higher customer-acquisition and installation costs and limited economies of scale (due to dispersion), resulting in structurally lower returns and less predictable cashflows. TerraForm Power,

[5] Lawrence Berkeley National Laboratory. (2014). Wind Technologies Market Report U.S. Energy Department
[6] Wiser, R., & Bolinger, M. (2019). Benchmarking Anticipated Wind Project Lifetimes
[7] Hall, M. (2016). Determining the Value of Renewable Assets After the Expiration of PPA. Duke University.
[8] Renewables Now, New investor may file claims against TerraForm Power, SunEdison (2015)

SunEdison's YieldCo, had agreed to acquire Vivint's operating portfolio for $799 million, revised down from $922 million after pressure from activist shareholder Appaloosa Management.

Appaloosa Management, one of TerraForm's major shareholders, publicly criticized the transaction as a clear deviation from the company's established business model. In its letter to TerraForm's Board, Appaloosa argued that "the acquisition of the Vivint Solar portfolio of residential rooftop assets marks an unfortunate departure from this business model and appears to serve the sole purpose of promoting SUNE's desire to acquire VSLR's development and operating assets, rather than enhancing the quality and value of TERP's holdings." The letter further warned that the proposed shift toward residential rooftop projects, "weaker counterparties (homeowners)" and "higher risk profile inherent in these assets (small rooftop panels)", would disproportionately benefit SunEdison's incentive distribution rights, a mechanism allowing the sponsor to capture a growing share of dividends as payouts increased, thereby rewarding the sponsor while transferring greater financial risk to TERP.

The Vivint Solar acquisition was not merely the beginning of the end for SunEdison; it was the end itself. By pursuing yet another acquisition at an inflated price, anchored by a massive development pipeline, SunEdison reinforced investors' deepest concerns about its strategic judgment and lack of financial discipline.

b) *Tyler Ogden (Lux Research) said* ***"It's an example of a large developer that tried expanding way too fast in too many directions in a poorly managed way."***

SunEdison's collapse wasn't about growing fast, but about growing wrong. The problem was not the pace of expansion itself, "expanding way too fast" but the poor execution and lack of strategic focus that accompanied it, "poorly managed way".

Fortune (2016) reported that "SunEdison bought entire developers rather than individual projects, taking on large pipelines still under construction and unable to produce stable cash flows." Between 2014 and 2015, the company acquired more than ten renewable energy developers worldwide, including First Wind (United States), Globeleq Mesoamerica (Central America), Continuum Wind Energy (India), and Fotowatio Renewable Ventures (Spain).

First, by acquiring entire corporate entities instead of individual projects, SunEdison inherited additional layers of complexity, including overlapping management teams, redundant operations, and contingent liabilities. Many of these newly acquired companies required subsequent restructurings to eliminate duplicated functions and reduce labor costs, consuming time and resources that could otherwise have been directed toward project development and execution. Internal accounts later confirmed the depth of these integration problems: a former Senior Auditor and Accountant described the consolidation process as "a nightmare to consolidate," while court filings characterized the company's reporting as "a mishmash of disparate systems with insufficient controls over access or content" (U.S. District Court, 2016, p. 9). In September 2015, SunEdison announced a 15% global workforce reduction, explicitly citing duplicated business activities after its acquisition spree and recognizing between $30 million and $40 million in restructuring charges (Form 10-Q, Q3 2015, p. 57). These measures showed that instead of creating synergies, the acquisition strategy had generated inefficiencies that the company later struggled to correct.

Moreover, this aggressive acquisition strategy left SunEdison with a portfolio heavily concentrated on development-stage assets, inherently exposed to greater uncertainty and execution risk. Unlike operational assets, projects under development face permitting delays, construction setbacks, cost overruns, and sensitivity to market or regulatory changes. These factors not only postponed revenue recognition but also weakened cash flow predictability, a cornerstone of financial stability in the renewable energy sector. These weaknesses became particularly evident in a volatile policy environment. In the United Kingdom, for example, the government's 2015 decision to reduce solar feed-in tariffs by nearly 90% (Reuters, 2015) abruptly reshaped project economics, eroding the expected profitability of early-stage developments. For a company like SunEdison, whose portfolio was heavily concentrated on unfinished and incentive-dependent projects, such policy reversals significantly amplified exposure to regulatory and market risk.

Some public examples of difficulties related to development-stage projects are linked to SunEdison's acquisition of First Wind. Among the most notable cases was the Oakfield Wind Project in Maine, a 150 MW asset that faced a federal lawsuit from the environmental group Protect Our Lakes. The group alleged violations of the Endangered Species Act, the Bald and Golden Eagle Protection Act, and the Clean Water Act, citing risks to wetlands and Atlantic salmon habitats. Although SunEdison ultimately prevailed in court, the legal proceedings led

to delays and increased costs. Another problematic asset was the Weaver Wind Project, also in Maine, with a planned capacity of 73 MW. Still in development at the time, the project encountered regulatory challenges when the Maine Public Utilities Commission reassessed the terms of its Power Purchase Agreement. Without a secured revenue stream, SunEdison withdrew from the project, which remained stalled. The King Pine Wind Project, a 600 MW initiative in early development, further illustrates the risks of acquiring immature assets. Located in unorganized territory in Maine, the project faced complex permitting and grid interconnection issues that added uncertainty to its timeline and execution. Consequently, the projected cash flows of many development-stage assets deviated materially from initial expectations, as unforeseen legal, regulatory, and permitting challenges increased costs and extended completion timelines.

By 2015, most of SunEdison's assets were still under development, requiring constant financing while generating little to no operating cash flow. The company increasingly relied on debt and equity issuances to sustain construction and acquisitions, creating a persistent mismatch between operating income and financial obligations. Instead of channeling capital toward the completion and monetization of projects, SunEdison diverted significant resources into unfinished and illiquid assets, eroding liquidity and limiting balance-sheet flexibility. The operational consequences of this misallocation soon became apparent. In Hawaii, the local utility terminated three SunEdison power purchase agreements after repeated failures to meet construction milestones, a clear demonstration of how weak project execution and poor capital prioritization translated into lost revenues and reputational damage. SunEdison consistently failed to deliver on its ambitious project targets, as a large share of its reported pipeline never materialized into operational capacity. According to court filings, "many projects reported as 'under construction' were substantially incomplete or inactive," revealing a systematic overstatement of progress (U.S. District Court, 2016, p. 10). These persistent delays were aggravated by the company's dependence on milestone-based financing structures: "delays in project completion or failure to meet these milestones restricted cash inflows" (SunEdison, 2014, p. 42). As a result, the company entered a self-reinforcing liquidity trap, without completing projects, it could not access committed funding, and without funding, it could not complete construction.

Additionally, the company consistently overpaid for assets that generated limited immediate returns, driven by the need to sustain its growth narrative and feed its YieldCos

rather than by sound investment discipline. This pattern of overpriced and strategically misaligned acquisitions amplified financial pressure and reinforced the liquidity constraints.

Ultimately, SunEdison's downfall was not driven by the pace of expansion but by its inability to convert growth into sustainable cash flows. The combination of high leverage, poor project execution, and an illiquid asset base made the company highly exposed to tightening credit conditions. When capital markets contracted in late 2015, the model collapsed.

c) ***"Solar industry watchers said the bankruptcy was not a reflection of the sector, which is growing rapidly. "SunEdison had a balance sheet that is way out of line with any other solar company," said Shayle Kann, GTM Research.***

During 2015, the Global YieldCo Index declined by nearly 60% from its mid-year peak, reflecting a sharp loss of investor confidence in highly leveraged renewable developers (Climate Policy Initiative, 2016). In parallel, broader equity markets also weakened: the S&P 500 fell by roughly 10% between mid-2015 and early 2016, amid rising global risk aversion and expectations of tighter monetary policy (Bloomberg, 2016).

While some analysts, such as Shayle Kann from GTM Research, argued that SunEdison's bankruptcy was an isolated case, the broader evidence suggests otherwise. Several renewable energy firms faced similar financial strain between 2015 and 2017, as tightening monetary conditions and shifting investor sentiment exposed the vulnerabilities of highly leveraged models across the sector.

In Spain, Abengoa filed for insolvency protection in November 2015, burdened by $9.3 billion in debt (Reuters, 2015). In the United States, NRG Energy was forced to reassess its renewable strategy after its YieldCo, NRG Yield, lost nearly 45% of its market value between mid-2015 and early 2016 (Bloomberg, 2016). Even financially stronger peers such as First Solar and SunPower saw their share prices decline by 38% and 41%, respectively, over the same period (Yahoo Finance, 2016).

SunEdison's bankruptcy, therefore, cannot be interpreted as an isolated failure but rather as part of a broader market correction triggered by tightening financial conditions and a shift in investor risk perception. The collapse resulted from a combination of external pressures, rising interest rates, falling oil prices, and declining investor tolerance for leveraged growth, and internal vulnerabilities, including high financial leverage, poor

integration of acquired companies, weak project execution, and an overreliance on short-term financing for long-term development assets. These factors ultimately culminated in a severe liquidity crisis in early 2016, when capital markets closed to highly leveraged developers, cutting off access to external financing and forcing SunEdison to file for bankruptcy protection.

d) "The Strategic mistake I made was putting all my eggs into the YieldCo basket during a market discontinuity" Ahmad Chatila, CEO SunEdison

Ahmad Chatila's assertion that SunEdison failed because it "put all its eggs into the YieldCo basket" oversimplifies the company's downfall.

At launch, TerraForm Power controlled 523 MW of renewable capacity, yet achieved a market capitalization of $3.0 billion, comparable to peers like Abengoa Yield ($3.0B, 710 MW) and NextEra Energy ($3.1B, 989 MW). TerraForm Power's valuation was driven less by current fundamentals and more by SunEdison's promise of rapid dividend escalation, a speculative proposition compared to peers that offered higher yields and larger portfolios. Investors appear to have priced aggressive growth expectations, valuing future expansion over current income generation, particularly in the case of TerraForm Power. (exhibit 7)

The YieldCo model relied on cheap equity and debt to fund acquisitions, promising 12–15% annual dividend growth. Rising interest rates or inflation expectations will make the dividend yields provided by US YieldCos comparatively less attractive than fixed-income securities. At that time, benchmark interest rates in developed countries were close to 0%, which raised concerns that any increase in rates could force investors to offer higher yields to attract capital.

Between 2013 and 2015, the yield on the U.S. 10-year Treasury note rose from 1.6% to nearly 3.0% during the so-called Taper Tantrum (Federal Reserve, 2013), narrowing the spread against average YieldCo dividend yields of 5–6% (Bloomberg, 2015). As financing conditions tightened in mid-2015, the entire YieldCo sector experienced a sharp revaluation. The Global YieldCo Index compiled by Bloomberg New Energy Finance declined by 57% between July and December 2015, reflecting the collapse of investor confidence in the sustainability of double-digit dividend growth. Over the same period, TerraForm Power's share price fell from a peak of $42 (July 2015) to under $15 (December 2015), while NRG Yield and Abengoa Yield dropped by roughly 45% and 40%, respectively (Bloomberg, 2015; Financial Times, 2016).

While the YieldCo model was conceptually sound, SunEdison's implementation distorted its financial logic. The company relied heavily on short-term corporate and bridge financing to fund the construction and acquisition of long-term renewable projects, expecting to recover cash through future dropdowns to its YieldCos. As stated in court filings, "SunEdison's liquidity was increasingly tied up in unfinished projects, while debt maturities accumulated at the corporate level" (U.S. District Court, 2016). When capital markets tightened and YieldCos' share prices collapsed, new equity issuance became impossible, cutting off SunEdison's main source of liquidity.

Importantly, YieldCos themselves were not the source of the problem: they acquired only operational projects and continued to pay dividends based on cash-generating assets. However, SunEdison's reliance on short-term debt to finance development-stage projects created a severe maturity mismatch between the timing of project cash flows and debt repayments. This imbalance was the true financial weakness that ultimately drove the company's collapse.

In analytical terms, SunEdison's bankruptcy illustrates the distinction between a structural market failure and firm-specific mismanagement. The YieldCo structure remained operationally and financially sustainable for disciplined sponsors; SunEdison's deviation from these fundamentals, excessive leverage, liquidity mismatches, and a reliance on development-stage assets, transformed a sound financial instrument into a source of fragility. Therefore, Chatila's claim that the YieldCo model was to blame oversimplifies a collapse rooted in operational execution failures rather than in structural market flaws.

Governance failures further exacerbated SunEdison's financial fragility. The company lacked clear boundaries between itself and its listed subsidiaries, TerraForm Power and TerraForm Global, which, despite being presented as independent entities, remained under tight operational and financial control from the parent company. SunEdison decided which projects would be sold to YieldCos, at what price, and when, often prioritizing its own short-term liquidity needs over the subsidiaries' financial discipline. In 2016, TerraForm Global disclosed that SunEdison had diverted approximately $231 million intended for project acquisitions to cover corporate cash shortfalls (TerraForm Global 10-K, 2016). Similarly, TerraForm Power was bound by "take-or-pay" agreements requiring it to buy SunEdison's projects regardless of viability (SEC Filing, 2016). These practices reflected weak governance and conflicts of interest that ultimately deepened the company's liquidity crisis.

5. Conclusion

MEMC is frequently perceived as a strong foundation for SunEdison's growth, but this view overlooks key structural flaws. MEMC operated primarily upstream where it faced significant cost disadvantages. When market conditions shifted in 2009, MEMC's inefficiencies became clear. SunEdison inherited this upstream legacy but failed to convert it into meaningful efficiency gains. Eventually, the company pivoted toward downstream activities, where it sought to create value through long-term PPAs and YieldCos.

During its aggressive expansion, many analysts and investors recognized that SunEdison was taking on significant debt but failed to grasp the true nature of the company's fragility.

This mismatch between strategy and execution was overlooked, as market enthusiasm for renewables masked the underlying risks. Several concrete factors illustrate how SunEdison's strategy exposed the company to structural vulnerabilities. Many acquisitions were overpriced, further weakening the company's financial position. Execution delays were common, projects like those acquired from First Wind faced permitting, grid connection, and land acquisition challenges, which postponed expected cash flows. Regulatory and policy shifts, such as reductions in feed-in tariffs and delays in tax credit extensions, disrupted financial projections. Moreover, SunEdison overestimated the capacity of its YieldCos to absorb new assets at favorable valuations, as market sentiment shifted and share prices declined, this pipeline stalled. Finally, rising capital costs made it increasingly difficult to refinance short-term debt or raise equity on acceptable terms, deepening the liquidity crisis.

The flaw in SunEdison's strategy lay not in the pace of investment, but in the nature of the assets it pursued, concentrated in early-stage developments and overpriced acquisitions repeated in a self-reinforcing cycle to sustain asset flow, ultimately lacking strategic coherence. Instead, SunEdison deployed large amounts of capital into development-stage projects with uncertain timelines and acquired entire companies without clear operational synergies. Ultimately, the strategy lacked discipline: it was not just aggressive, it was structurally inaccurate.

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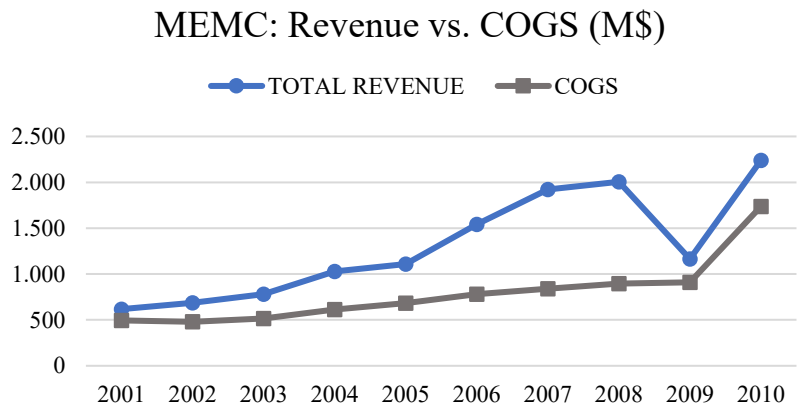
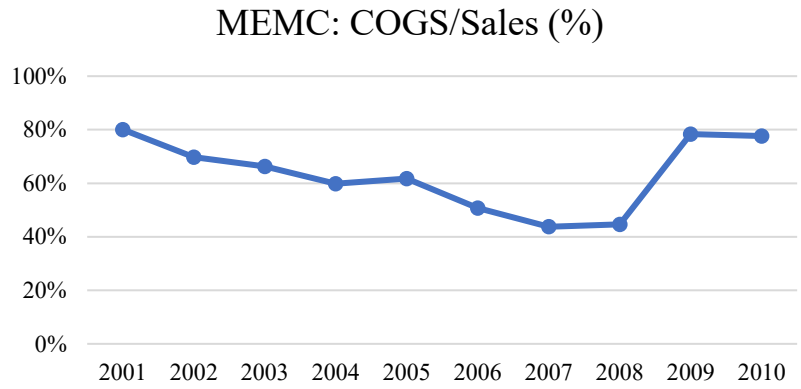
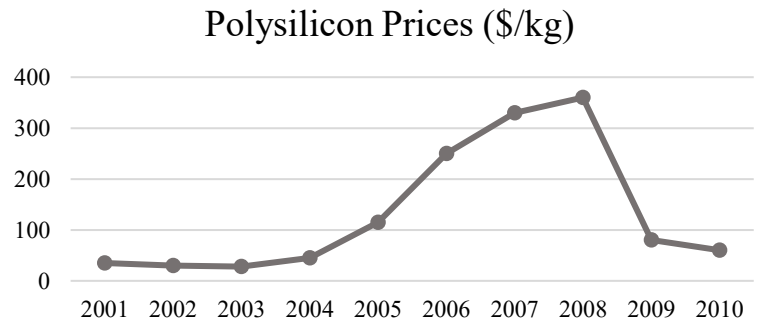
Appendix 1

Exhibit 1. MEMC's Cost Structure and Exposure to Silicion Price Cycles (2001-2010)

Source: MEMC Annual Reports; Bernreuter Research (2018); Gartner Wafer Price Index;







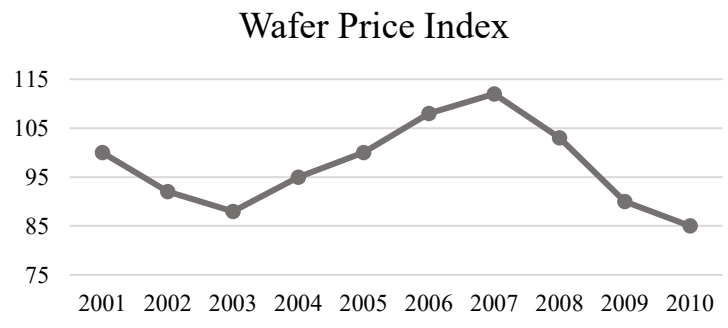


Exhibit 2. Operating Margins of MEMC and Peers between 2001 and 2005 (%)

Source: Own analysis based on company annual reports (MEMC, SUMCO, Shin-Etsu).

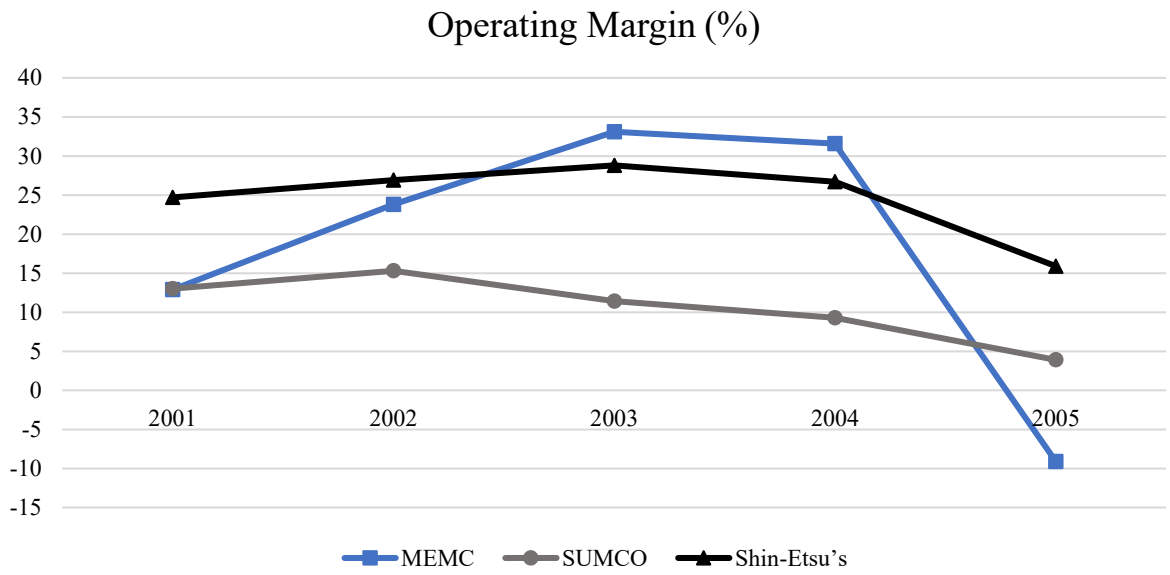


Exhibit 3. Sales evolution per segment 2009-2012 ($Millions)

Source: Own analysis based on company annual reports MEMC

	2009	2010	2011	2012	CAGR 2009-12	CAGR 2010-12
Semiconductor Materials	586	993	1.023	918	12%	-3%
Solar Materials	574	826	957	460	-5%	-18%
Solar Energy	4	421	735	1.152	317%	40%
Total Sales	**1.164**	**2.239**	**2.716**	**2.530**	**21%**	**4%**

Exhibit 4. Stock Evolution from April 2015 until April 2015.

Source: Reuters

Exhibit 5. Portfolio TerraForm Power in February 2015

Source: Own Analysis based on TerraForm 2014 annual report

Facility Name	Location	Facility Type	COD	Nameplate Capacity (MW)	# of Sites	Weighted Average Remaining Years of PPA
HES Portfolio	U.S.	DG Solar	2011-2014	25	42	19
Summit Solar Proj. Massachusetts	U.S.	DG Solar	2013	20	50	13
Capital Dynamics Portfolio	U.S.	DG Solar	2011-2014	78	101	15
Other Distributed Generation	U.S.	DG Solar	2011-2015	161	91	18
Mt. Signal	U.S.	Solar	2014	266	1	24
Regulus Solar	U.S.	Solar	2014	82	1	20
North Carolina Portfolio	U.S.	Solar	2014-2015	26	4	15
Atwell Island	U.S.	Solar	2013	24	1	23
Nellis	U.S.	Solar	2007	14	1	13
Alamosa	U.S.	Solar	2007	8	1	13
CalRENEW-1	U.S.	Solar	2010	6	1	15
Marsh Hill	Canada	Solar	2015	19	1	20
SunE Perpetual Lindsay	Canada	Solar	2014	16	1	20
Stonehenge Q1	U.K.	Solar	2014	41	3	14
Fairwinds and Crundale	U.K.	Solar	2014	50	2	15
Stonehenge Operating	U.K.	Solar	2013	24	3	13
Says Court	U.K.	Solar	2014	20	1	14
Crucis Farm	U.K.	Solar	2014	16	1	14
Norrington	U.K.	Solar	2014	11	1	14
CAP (6)	Chile	Solar	2014	102	1	19
Cohocton	U.S	Wind	2009	125	1	6
Rollins	U.S	Wind	2011	60	1	17
Stetson I	U.S	Wind	2009	57	1	5
Mars Hill	U.S	Wind	2007	42	1	1
Sheffield	U.S	Wind	2011	40	1	17
Bull Hill	U.S	Wind	2012	35	1	13
Kaheawa Wind Power I	U.S	Wind	2006	30	1	12
Kahuku	U.S	Wind	2011	30	1	16
Stetson II	U.S	Wind	2010	26	1	11
Kaheawa Wind Power II	U.S	Wind	2012	21	1	18
Steel Winds I	U.S	Wind	2007	20	1	5
Not defined	U.S	Wind	2012	15	1	5
Total Owned as of February 20, 2015				**1507,3**	**412**	**16**
Total Owned as of December 31, 2013				531	196	
Acquired 2014				456	200	
Acquired Subsequent to December 31, 2014				521	16	

Exhibit 6. Simplified DCF – First Wind (2015)

Source: Own Analysis based on information available in TerraForm Power

Facility Name	Location	Facility Type	COD	Nameplate Capacity (MW)	# of Sites	Weighted Average Remaining Duration of PPA (Years)	€/MWh	Load Factor (2)	Annual Revenue (M€)	O&M (M€)	Annual Profit	PTC Remaining Duration	PTC Impact	Annual Profit After PPA	Expected Life in 2015 After PPA	Remain Value	DCF (M€)
Cohocton	NY	Wind	2009	125	1	6	70	22%	17	6	11	5	6	7	13	34	110
Rollins	Maine	Wind	2011	60	1	17	75	30%	12	3	9	7	4	5	4	5	106
Stetson I	Maine	Wind	2009	57	1	5	75	20%	8	3	5	5	2	3	14	17	46
Mars Hill	Maine	Wind	2007	42	1	1	75	30%	8	2	6	3	3	4	16	31	44
Sheffield	Vermont	Wind	2011	40	1	17	75	30%	8	2	6	7	3	4	4	3	71
Bull Hill	Maine	Wind	2012	34,5	1	13	75	30%	7	2	5	8	2	3	9	7	60
Kaheawa Wind Power	Hawai	Wind	2006	30	1	12	136	30%	11	2	9	2	2	5	4	7	77
Kahuku	Hawai	Wind	2011	30	1	16	206	30%	16	2	14	7	2	9	5	10	145
Stetson II	Maine	Wind	2010	25,5	1	11	75	20%	3	1	2	6	1	1	9	4	24
Kaheawa Wind Power	Hawai	Wind	2012	21	1	18	207	30%	11	1	10	8	1	6	4	5	106
Steel Winds I	NY	Wind	2007	20	1	5	70	30%	4	1	3	3	1	2	12	9	23
Not defined	NY	Wind	2012	15	1	5	70	30%	3	1	2	8	1	1	17	8	21
WIND PROJECTS			**2009-20**	**500**					**108**	**24**	**84**		**28**			**137**	**835**
Not defined	NY	Solar	2012	21	1	18	70	25%	3	0	3	8		2	4	1	28
TOTAL				**836**					**111**							**139**	**863**

Exhibit 7. The Yieldco Landscape

Source: All market cap information gathered from Bloomberg on August 1, 2014.

	Portfolio	Renewable Assets (MW-electric)	Total Assets (MW)	Total Capital Raised	Market Cap	Yield (Annual)
NRG Yield, Inc.	Conventional, solar, wind, thermal	1401	2984	$840 million	$3.9 billion	5.45%
Pattern Energy Group, Inc.	Wind	1932	1932	$938 million	$1.9 billion	6.25 %
Abengoa Yield Plc.	Solar, wind, conventional, electric transmission	710	1010; 1018 mi	$829 million	$3.0 billion	3.6 %
TransAlta Renewables, Inc.	Wind,hydro	1378	1378	C$346million (US$323)	$1.3 billion	7.5 %
NextEra Energy Partners, LP	Wind, Solar	989	989	$406 million	$3.1 billion	6.25%
TerraForm Power, Inc.	Solar	523	523	$500 million	$3.0 billion	4.5% (expected)

Exhibit 8. Reformulated Profit and Loss MEMC 2001-2014

Source: Own analysis based on company annual reports

REFORMULATED P&L (€M)	A 2001	A 2002	A 2003	A 2004	A 2005	A 2006	A 2007	A 2008	A 2009	A 2010	A 2011	A 2012	A 2013	A 2014
CORE BUSINESS														
TOTAL REVENUE	**618**	**687**	**781**	**1.028**	**1.107**	**1.541**	**1.922**	**2.005**	**1.164**	**2.239**	**2.716**	**2.530**	**2.008**	**2.484**
Solar	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1.081**	**578**	**1.246**	**1.692**	**1.612**	**1.101**	**1.594**
%Revenues	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*54%*	*50%*	*56%*	*62%*	*64%*	*55%*	*64%*
Semiconductor Materials	**618**	**687**	**781**	**1.028**	**1.107**	**1.541**	**1.922**	**923**	**586**	**993**	**1.023**	**918**	**906**	**840**
%Revenues	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*46%*	*50%*	*44%*	*38%*	*36%*	*45%*	*34%*
TerraForm Power	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**126**
%Revenues	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*5%*
Other	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**1**	**-76**
COGS	-495	-480	-517	-614	-684	-781	-841	-896	-912	-1.737	-2.194	-1.947	-1.594	-1.905
GROSS PROFIT	**123**	**208**	**264**	**414**	**424**	**759**	**1.081**	**1.109**	**252**	**502**	**522**	**583**	**414**	**579**
Gross Margin %	*19,9%*	*30,2%*	*33,8%*	*40,2%*	*38,3%*	*49,3%*	*56,3%*	*55,3%*	*21,7%*	*22,4%*	*19,2%*	*23,0%*	*20,6%*	*23,3%*
SG&A Costs (w/out D&A)	**-70**	**-66**	**-57**	**-72**	**-76**	**-95**	**-111**	**-107**	**-162**	**-267**	**-353**	**-275**	**-362**	**-571**
D&A	**-175**	**-34**	**-31**	**-44**	**-57**	**-70**	**-81**	**-104**	**-149**	**-165**	**-693**	**-267**	**-305**	**-492**
Depreciation	-175	-34	-31	-44	-57	-70	-79	-104	-124	-159	-227	-247	-268	-357
Amortization & depletion	0	0	0	0	0	0	-1	0	-25	-6	-465	-20	-37	-135
R&D	**-66**	**-27**	**-33**	**-38**	**-33**	**-36**	**-39**	**-41**	**-40**	**-56**	**-88**	**-72**	**-71**	**-62**
CORE RESULT BEFORE	**-187**	**80**	**143**	**259**	**257**	**558**	**850**	**858**	**-99**	**14**	**-611**	**-30**	**-324**	**-545**
Operating Margin %	*-30%*	*12%*	*18%*	*25%*	*23%*	*36%*	*44%*	*43%*	*-8,5%*	*1%*	*-22%*	*-1%*	*-16,2%*	*-22%*
Tax	*-152*	*-69*	*-34*	*52*	*3*	*-203*	*-216*	*-286*	*42*	*-62*	*-32*	*-24*	*-15*	*15*
CORE RESULT AFTER T	**-339**	**12**	**109**	**312**	**260**	**356**	**635**	**572**	**-57**	**-47**	**-643**	**-54**	**-340**	**-530**
NON-CORE BUSINESS														
Restructuring Costs	**-32**	**-15**	**0**	**-60**	**0**	**0**	**0**	**-4**	**-28**	**7**	**-690**	**88**	**-64**	**18**
Other Income/(Expenses)	**-3**	**21**	**19**	**8**	**-2**	**20**	**218**	**-313**	**5**	**-10**	**-11**	**-7**	**-21**	**-65**
NON CORE RESULT BEF	**-35**	**6**	**19**	**-52**	**-2**	**20**	**218**	**-317**	**-24**	**-4**	**-701**	**81**	**-85**	**-47**
Tax	*-29*	*-5*	*-4*	*-11*	*0*	*-7*	*-55*	*106*	*10*	*15*	*-37*	*64*	*-4*	*1*
NON CORE RESULT AFT	**-64**	**1**	**14**	**-63**	**-2**	**13**	**163**	**-211**	**-14**	**11**	**-738**	**145**	**-89**	**-46**
FINANCIAL BUSINESS														
Interest Expense	**-74**	**-67**	**-6**	**-9**	**-3**	**12**	**44**	**45**	**23**	**-24**	**-73**	**-132**	**-183**	**-381**
Loss on early debt	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-344**
FINANCIAL RESULT BEI	**-74**	**-67**	**-6**	**-9**	**-3**	**12**	**44**	**45**	**23**	**-24**	**-73**	**-132**	**-183**	**-725**
Tax	*-60*	*57*	*1*	*-2*	*0*	*-4*	*-11*	*-15*	*-9*	*100*	*-4*	*-105*	*-9*	*20*
Tax Adjustments	-2	1	6	-2	0	0	0	0	-12	7	-63	-2	6	8
FINANCIAL RESULT AFT	**-136**	**-8**	**2**	**-12**	**-3**	**8**	**33**	**30**	**1**	**84**	**-139**	**-239**	**-185**	**-697**
Investments in Associates and	**21**	**-9**	**-9**	**-11**	**-6**	**-6**	**-3**	**-2**	**2**	**-14**	**-16**	**-2**	**27**	**92**
SUNEDISON RESULT	**-519**	**-5**	**117**	**226**	**250**	**370**	**827**	**388**	**-68**	**34**	**-1.536**	**-151**	**-587**	**-1.181**
Margin %	*-84%*	*-1%*	*15%*	*22%*	*23%*	*24%*	*43%*	*19%*	*-6%*	*2%*	*-57%*	*-6%*	*-29%*	*-48%*

Exhibit 9. Reformulated Balance Sheet MEMC 2001-2014

Source: Own analysis based on company annual reports

REFORMULATED BS (€M)	A 2001	A 2002	A 2003	A 2004	A 2005	A 2006	A 2007	A 2008	A 2009	A 2010	A 2011	A 2012	A 2013	A 2014
Inventories	70	85	109	128	120	80	36	81	141	215	322	248	248	226
Trade receivables	67	95	103	159	125	199	198	197	173	296	203	220	352	373
Other receivables	0	0	0	0	0	0	0	0	130	317	498	226	791	426
Operating Current Assets	**137**	**180**	**213**	**287**	**245**	**279**	**234**	**279**	**444**	**828**	**1.023**	**694**	**1.390**	**1.025**
Trade payables	52	68	95	124	106	125	168	162	219	746	695	477	868	1.098
Other liabilities	94	94	77	107	114	127	271	304	258	467	594	473	624	970
Operating Current Liabilities	**146**	**162**	**172**	**231**	**220**	**253**	**439**	**467**	**477**	**1.212**	**1.289**	**950**	**1.492**	**2.068**
Net Operating Current Assets	**-8**	**18**	**40**	**56**	**25**	**26**	**-205**	**-188**	**-33**	**-385**	**-266**	**-257**	**-101**	**-1.043**
Net PPE	201	185	270	445	495	604	834	1.041	1.466	2.034	2.393	2.673	3.123	6.476
Investments	0	0	0	0	0	0	0	0	298	110	55	50	41	151
Other non-current assets	81	79	91	175	217	263	464	436	227	336	399	449	500	1.424
Operating Invested Capital	**282**	**264**	**361**	**620**	**712**	**866**	**1.298**	**1.477**	**1.990**	**2.479**	**2.847**	**3.172**	**3.664**	**8.051**
Other Assets	4	4	0	0	0	0	0	6	327	395	149	114	632	659
Restricted Cash	20	18	22	30	38	35	39	39	87	202	277	212	420	909
Non-Operating Assets	**23**	**22**	**22**	**30**	**38**	**35**	**39**	**45**	**414**	**598**	**426**	**326**	**1.051**	**1.568**
Pension and Other Liabilities	101	105	126	97	91	85	61	46	47	54	69	53	0	0
Minority interest	51	58	64	46	45	39	36	35	38	44	47	102	109	1.252
Other Long-Term Liabilities	51	46	39	72	41	188	286	275	420	368	812	614	1.271	954
Non-Operating Liabilities	**203**	**209**	**230**	**216**	**177**	**311**	**382**	**356**	**504**	**466**	**928**	**768**	**1.380**	**2.206**
Non-Operating Invested Capital	**-180**	**-188**	**-208**	**-186**	**-140**	**-277**	**-344**	**-311**	**-90**	**132**	**-502**	**-442**	**-329**	**-638**
Total Invested capital	**93**	**94**	**194**	**489**	**598**	**616**	**750**	**978**	**1.867**	**2.227**	**2.079**	**2.473**	**3.233**	**6.370**
Current Loans & Borrowings	76	124	72	23	5	5	5	6	32	72	148	184	398	1.078
Non-Current Loans & Borrowings	149	161	59	116	35	29	26	26	384	168	856	1.088	1.807	4.447
Non-Current Lease liabilities	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	443	923	1.179	1.372	1.468
Total Financial Debt	**225**	**285**	**131**	**139**	**40**	**34**	**31**	**32**	**417**	**683**	**1.927**	**2.451**	**3.576**	**6.993**
Cash and cash equivalents	107	166	131	92	154	585	1.316	1.137	719	707	586	554	575	856
Total Cash and cash equivalents	**107**	**166**	**131**	**92**	**154**	**585**	**1.316**	**1.137**	**719**	**707**	**586**	**554**	**575**	**856**
Net Financial Debt	**118**	**119**	**0**	**46**	**-114**	**-551**	**-1.286**	**-1.105**	**-302**	**-25**	**1.341**	**1.898**	**3.001**	**6.137**
Equity	**-24**	**-25**	**194**	**443**	**711**	**1.167**	**2.035**	**2.082**	**2.169**	**2.252**	**738**	**575**	**232**	**233**
Total Funds Reconciliation	**93**	**94**	**194**	**489**	**598**	**616**	**750**	**978**	**1.867**	**2.227**	**2.079**	**2.473**	**3.233**	**6.370**

Exhibit 10. Reformulated Balance Sheet MEMC 2001-2014

Source: Own analysis based on company annual reports

REFORMULATED CF (€M)	A 2001	A 2002	A 2003	A 2004	A 2005	A 2006	A 2007	A 2008	A 2009	A 2010	A 2011	A 2012	A 2013	A 2014
Core NOPAT	-339	12	109	312	260	356	635	572	**-57**	**-47**	**-643**	**-54**	**-340**	**-530**
(+) D&A	175	34	31	44	57	70	81	104	149	165	693	267	305	492
(+) Other Adjustments	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Core Operating Gross Cash Flow	**-165**	**46**	**140**	**356**	**317**	**426**	**715**	**676**	**91**	**117**	**49**	**212**	**-35**	**-38**
NWC	86	-27	-5	-45	23	-14	88	-50	22	329	-65	-161	259	231
Capex	996	-17	-128	-302	-149	-224	-512	-283	-662	-654	-1.060	-592	-797	-4.879
(+) Other Adjustments	-58	1	-17	30	7	13	143	34	-177	22	-53	152	-414	711
Core Total Investments	**1.024**	**-43**	**-151**	**-318**	**-119**	**-226**	**-281**	**-300**	**-817**	**-303**	**-1.178**	**-601**	**-952**	**-3.938**
Core FCF	**859**	**3**	**-11**	**39**	**198**	**200**	**434**	**376**	**-725**	**-185**	**-1.129**	**-389**	**-987**	**-3.976**
Non-core NOPAT	-64	1	14	-63	-2	13	163	-211	-14	11	-738	145	-89	-46
Inc./(loss) from Inv. in JV	21	-9	-9	-11	-6	-6	-3	-2	2	-14	-16	-2	27	92
(-) Change in Net Non-Op Assets	21	8	20	-22	-46	137	67	-32	-221	-222	634	-59	-113	309
Non-Core FCF	**-22**	**-1**	**26**	**-96**	**-54**	**143**	**226**	**-246**	**-233**	**-225**	**-120**	**83**	**-175**	**356**
Free Cash Flow Firm	**837**	**2**	**15**	**-57**	**144**	**344**	**660**	**130**	**-959**	**-410**	**-1.249**	**-306**	**-1.162**	**-3.621**
Financial Result	136	8	-2	12	3	-8	-33	-30	-1	-84	139	239	185	697
Net Debt	829	-1	119	-46	160	437	734	-181	-803	-277	-1.366	-557	-1.104	-3.136
Equity	391	0	-218	-249	-268	-456	-868	-47	-87	-83	1.514	163	343	-1
Total Comprehensive Income	-519	-5	117	226	250	370	827	388	-68	34	-1.536	-151	-587	-1.181
Financial FCF	**837**	**2**	**15**	**-57**	**144**	**344**	**660**	**130**	**-959**	**-410**	**-1.249**	**-306**	**-1.162**	**-3.621**

Exhibit 11. Ratios MEMC 2001-2014

Source: Own analysis based on company annual reports

RATIOS	A 2001	A 2002	A 2003	A 2004	A 2005	A 2006	A 2007	A 2008	A 2009	A 2010	A 2011	A 2012	A 2013	A 2014
Net Profit	-519	-5	117	226	250	370	827	388	-68	34	-1.536	-151	-587	-1.181
Equity	-24	-25	194	443	711	1.167	2.035	2.082	2.169	2.252	738	575	232	233
ROE	**-142%**	**20%**	**-473%**	**117%**	**56%**	**52%**	**71%**	**19%**	**-3%**	**2%**	**-68%**	**-20%**	**-102%**	**-508%**
Net Profit Margin	-84%	-1%	15%	22%	23%	24%	43%	19%	-6%	2%	-57%	-6%	-29%	-48%
Asset Turnover	0,47	7,37	8,28	5,30	2,26	2,58	3,12	2,67	1,19	1,20	1,22	1,22	0,81	0,77
Equity Multiplier	358%	-381%	-382%	100%	110%	84%	53%	37%	47%	86%	99%	282%	430%	1392%
ROE	**-142%**	**20%**	**-473%**	**117%**	**56%**	**52%**	**71%**	**19%**	**-3%**	**2%**	**-68%**	**-20%**	**-102%**	**-508%**
NOPLAT - recurrent	-519	-5	117	226	250	370	827	388	-68	34	-1.536	-151	-587	-1.181
Operating Invested Capital	282	264	361	620	712	866	1.298	1.477	1.990	2.479	2.847	3.172	3.664	8.051
Operating ROIC	**-36%**	**-2%**	**44%**	**63%**	**40%**	**52%**	**95%**	**30%**	**-5%**	**2%**	**-62%**	**-5%**	**-19%**	**-32%**
COGS / Sales	80%	70%	66%	60%	62%	51%	44%	45%	78%	78%	81%	77%	79%	77%
R&D / Sales	11%	4%	4%	4%	3%	2%	2%	2%	3%	2%	3%	3%	4%	2%
SG&A/Sales	11%	10%	7%	7%	7%	6%	6%	5%	14%	12%	13%	11%	18%	23%
D&A / Sales	28%	5%	4%	4%	5%	5%	4%	5%	13%	7%	26%	11%	15%	20%
Recurrent Operating Margin	-30%	12%	18%	25%	23%	36%	44%	43%	-8%	1%	-22%	-1%	-16%	-22%
NWC / Sales	3%	-1%	2%	4%	5%	2%	1%	-10%	-16%	-1%	-14%	-11%	-13%	-4%
PPE / Sales	178%	29%	24%	26%	40%	32%	31%	42%	89%	65%	75%	95%	133%	126%
Goodwill&Intangibles / Sales	0%	0%	0%	0%	0%	0%	0%	0%	0%	13%	4%	2%	2%	2%
Other Assets-Liabilities / Sales	57%	12%	10%	9%	16%	14%	14%	23%	37%	10%	12%	16%	22%	20%
Operating Invested Capital/Sales	238%	40%	36%	39%	61%	48%	46%	55%	111%	87%	77%	102%	145%	143%
Pre-tax Operating ROIC	-13%	29%	51%	65%	38%	76%	95%	78%	-8%	1%	-29%	-1%	-11%	-15%
Tax Rate	-81%	85%	24%	-20%	-1%	36%	25%	33%	42%	426%	-5%	-80%	-5%	3%
Other Tax Adjustments	-100%	21%	-11%	23%	-5%	-5%	-26%	29%	-3%	-560%	-107%	-271%	-62%	-113%
Operating ROIC	**-36%**	**-2%**	**44%**	**63%**	**40%**	**52%**	**95%**	**30%**	**-5%**	**2%**	**-62%**	**-5%**	**-19%**	**-32%**