清洁光伏的降本增效实施之路

CleanTech’s implementation way of cost control and efficiency increase

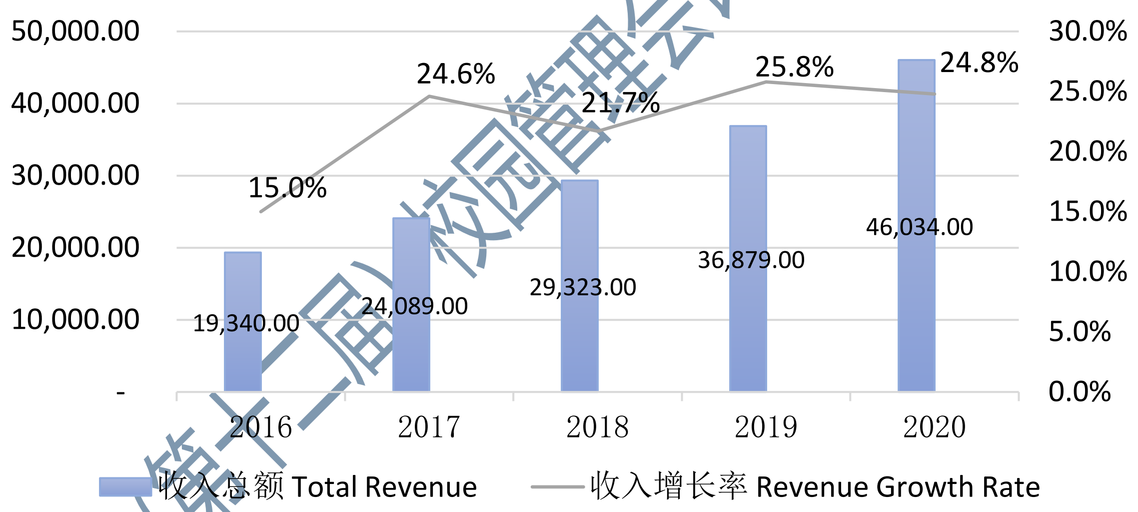
一、 案例摘要 Abstract

清洁光伏科技有限公司（以下简称公司）是一家为光伏组件企业配套生产光伏接线盒和连接器的高新技术电子制造企业，随着光伏行业景气度持续上升，公司近 3 年收入稳步增长（见图 1）。有着丰富光伏行业销售管理经验的董事长兼总经理朱峰（Daniel.Zhu）判断，光伏产业正处于蓝海市场，企业必须抓住新能源产业发展的机遇。2021 年，公司董事会制定了第二个三年战略目标，针对财务方面目标主要有：力争三年销售收入翻番（年复合增长率 26%），权益净利率不低于 20%，争取进入国内第一梯队光伏组件配套产品供应商行列。

Clean Photovoltaic Technology Co., Ltd. (hereafter referred as the Company or CleanTech Co.) is a high-tech electronic manufacturing enterprise that produces PV junction boxes and connectors for PV module enterprises. With the growing prosperity of the photovoltaic industry, the company's revenue has increased steadily in the past three years (see Figure 1). Daniel Zhu, chairman and general manager with rich experience in sales management in the photovoltaic industry, judged that the photovoltaic industry is in the blue ocean market, and the company must seize the opportunity of new energy industry development. In 2021, the board of directors of CleanTech Co. formulated the second three-year strategic objective. The financial objectives mainly include: strive to double the sales revenue in three years (compound annual growth rate of 26%), return on equity of no less than 20%, and strive to become the first tier of domestic suppliers of pv module supporting products.

图1：清洁光伏科技有限公司收入趋势图 单位：万元

Figure1: CleanTech Co's revenue trend Unit: Ten Thousand RMB



李明（Frank.Li）是公司老员工，历任采购助理、财务主管。兼有业务和财务工作经验的李明（Frank.Li）在日常工作中能帮财务部跨部门沟通，但由于管理会计知识的欠缺，遇到业务问题也常常陷入无能为力的境界，李明（Frank.Li）意识到管理会计知识的重要性，2020 年参加了 CMA 培训并取得了注册管理会计师（CMA）证书。为更好的承接公司战略目标，公司于 2021 年成立了管理会计部，李明（Frank.Li）主动请缨担任管理会计部负责人，主抓预算控制、经营分析、降本增效等工作。

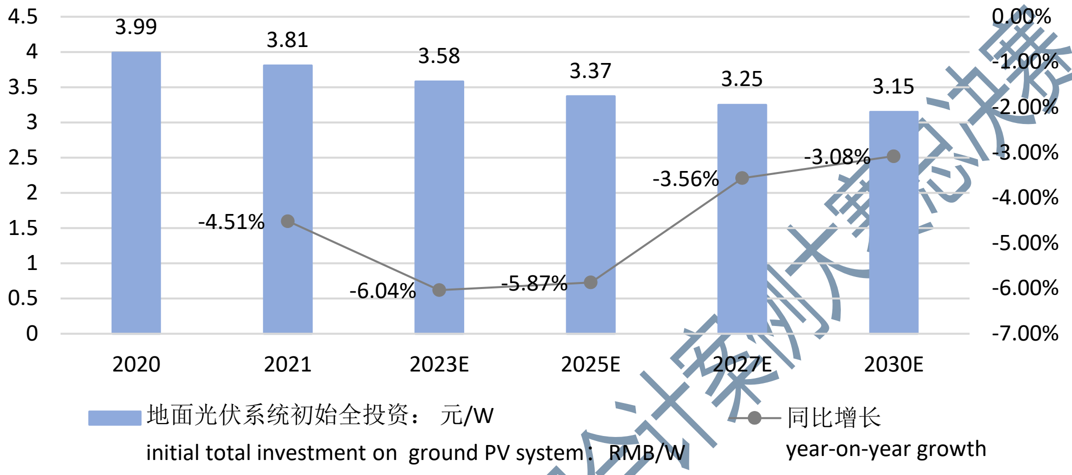
Frank Li is an old employee of the company, he had served as a purchasing assistant and financial director. With both business and financial work experience, he can support the financial department to communicate across departments in daily work. However, due to the lack of management accounting knowledge, he often falls into a state of helplessness when encountering business problems. Realizing the importance of management accounting knowledge, Frank Li participated in the CMA training and obtained the Certified Management Accountant (CMA) certificate in 2020. To better achieve the strategic objectives, the company established the Management Accounting Department in 2021. Frank Li took the initiative to bet the head of the Management Accounting Department, focusing on budget control, business analysis, control cost and increase efficiency.

随着光伏行业补贴退坡，光伏企业即将脱离对补贴的依赖，同时光伏发电平价上网目标压力巨大，迫使光伏制造企业加速技术创新，生产成本不断下降，光伏产业链各环节整体趋势为降本增效（图 2）。

With the decline of subsidies in the photovoltaic industry, photovoltaic companies are about to wean itself from subsidies. Meanwhile, facing at the huge pressure on the ordinary price for PV power delivered to the national power grid, photovoltaic enterprises have to accelerate technological innovation, and keep decreasing the production costs. The overall trend to all links of PV industry chain is to control cost and increase efficiency (see Figure 2).

图2　　2020-2030地面光伏系统初始全投资走势

Figure2: Trend of initial total investment on ground PV system



资料来源：根据光伏协会、《中国光伏产业发展路线图（2020 版）》等资料进行整理

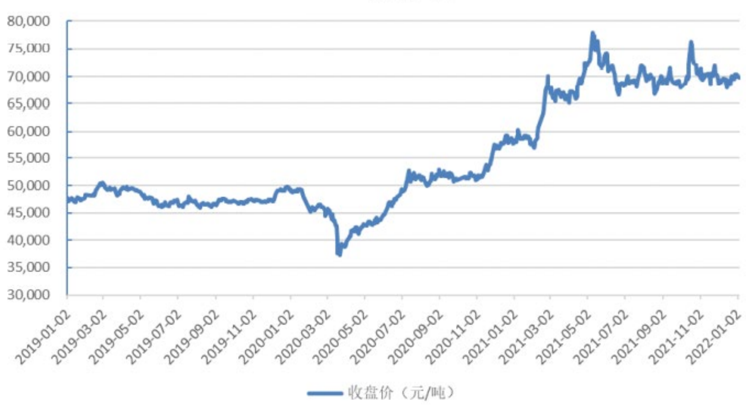
Data source: The data were sorted out according to data from Photovoltaic Association, 《China Photovoltaic Industry Development Roadmap (2020 edition)》 and other data

2021 年以来，由于疫情、俄乌冲突、中美贸易摩擦等多重影响，占公司产品成本 80%以上的原材料铜材、塑料粒子、二极管等大宗商品采购价格持续上涨（见图 3），海运费增加且时效延长，劳动力紧缺造成临时用工增加，公司面临成本上涨和资产周转速度下降压力。

Since 2021, due to the multiple impacts of the Convid-19 epidemic, Russia-Ukraine conflict, Sino-U.S. trade friction and other factors, the purchasing prices of bulk commodities such as copper, plastic particles,and diodes, which account for more than 80% of the company's product costs, continued to rise (see Figure 3), the sea freight has increased while the time of sea shipping extended, the labor shortage led to an increase in temporary employment. The company is facing the pressure of rising costs and declining asset turnover rate.

Figure3: SHFE copper price trend

图 3：　SHFE铜价走势



资料来源：上海期货交易所

Source: Shanghai Futures Exchange

由于原材料价格上升等因素导致产品成本上升，公司小幅上调了销售价格，但价格上调幅度不及成本上涨幅度，导致公司 2021 年毛利率同比预计下滑 10%左右，如公司不采取有效措施，将面临难以实现公司战略目标的风险。李明（Frank.Li）刚刚接手管理会计工作，如何帮助企业实现战略目标是他面临的最大难题。

Since the product cost increased by the rise of raw materials price, the company slightly increased its sales price. But the price increase can not catch up with the cost increase, hence the company's 2021 gross profit margin is estimated to decline by about 10%. If there is no effective measures, the company will face the risk of failing to achieve its strategic objectives. Frank Li has just taken over the work of management accounting. the biggest problem he faces is how to help the company achieve strategic objectives.

二、 行业介绍 Industry Introduction

近年来，随着全球对气候问题的重视，各国政府及机构陆续制定了更为积极严格的零碳排放行动计划，光伏发电作为一种清洁发电资源大受推广，加快发展可再生能源发电已逐渐成为全球统一意志，可再生能源发电具有广阔的市场空间（图 4）。2012 年-2015 年，我国光伏行业发展一定程度上仍受产业政策影响，尤其是财政补贴政策，2019 年 1 月，国家能源局发布《关于积极推进风电、光伏发电无补贴平价上网有关工作的通知》等政策，未来，随着光伏发电逐渐进入无补贴平价上网时代，光伏产品市场竞争必将激烈。

In recent years, with the global attention to climate issues, governments and institutions have successively formulated more active and strict zero-carbon emission plans. Photovoltaic power generation, as a clean power resource, has been widely promoted. Accelerating the development of renewable energy generation has gradually become a global consensus. Renewable energy generation has a broad market space (Figure 4). From 2012 to 2015, the development of China's photovoltaic industry was still affected partly by industrial policies, especially financial subsidy policies. In January 2019, the National Energy Administration issued policies including <Notice on Actively Promoting the Work of Non-subsidized and ordinary price for Wind Power and Photovoltaic Power Generation delivered to the national power grid>. In the future, when photovoltaic generation gradually enters non-subsidy era with ordinary price delivered to the national power grid, photovoltaic product companies will confront a quite competitive market.

图 4： 2021-2025 年中国光伏装机复合增速预测

Figure 4: Prediction of the Compound Growth Rate of China’s PV installations(2021-2025)

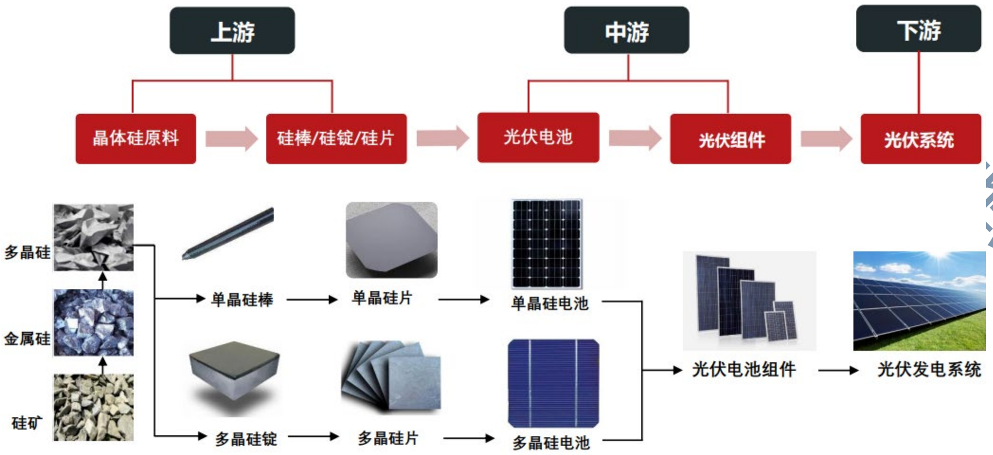
Data sources: National Energy Administration, National Bureau of Statistics, Kaiyuan Securities Research Institute

光伏产业链包括硅料、硅片、电池片、电池组件、应用系统 5 个环节。上游为硅料、硅片环节；中游为电池片、电池组件环节；下游为应用系统环节（图 5）；在整个产业链中，上游技术难度较大，进入壁垒较高，因此相对毛利率较好，中下游相对技术难度小，毛利率较差，特别是组件环节，现在有相当一部分组件厂处在亏损边缘。目前生产光伏接线盒和连接器的国内第一梯队光伏组件配套产品供应商主要有领先光伏和明熙光伏。

The photovoltaic production chain includes five links, namely silicon raw material, wafer, PV cells, PV battery module and PV application system. The upstream includes silicon raw material and wafer; the midstream consists of PV cells and battery module; the downstream is the link of the PV application system (Figure 5). In the whole industrial chain, the entry barrier is high for the upstream by relatively more difficult technologies, therefore the gross profit rate is good. Since there are less technology difficulties in the midstream and downstream, the gross profit rate is relatively low there, especially for the PV model link. Currently there are a number of PV module factories standing on the edge of business losses. At present, Lingxian PV and Mingxi PV are the main suppliers in the first tier of PV module supporting products producing PV junction boxes and connectors.

图 5：光伏产业链

Figure 5: Photovoltaic Industry Production Chain



摘自 ETF 周报《光伏暴涨，机会来了吗？》（2021 年 6 月 14 日）

Excerpted from ETF Weekly Report <Photovoltaic Boom, Is the Opportunity Coming?> (June 14, 2021)

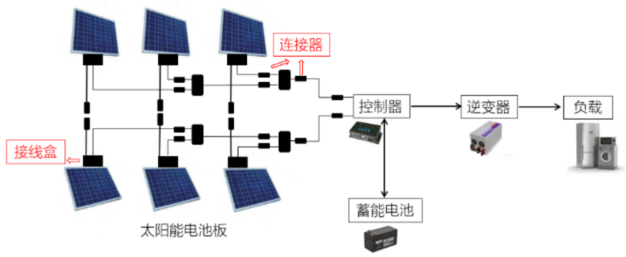
三、 公司介绍 Company Introduction

清洁光伏科技有限公司成立于 2012 年，专注于新能源太阳能光伏组件及光伏电站的电气保护和连接领域，主要从事光伏接线盒和光伏连接器系列产品的研发、生产和销售。光伏接线盒和连接器是光伏组件的“调控中枢”（图 6），成本占组件的比重虽然不足 3%，但安全性及其重要，属于光伏产业链中游配套企业。公司已于 2018 年取得国家高新技术企业称号，具有为各大太阳能光伏组件厂商定制化研发、生产核心配件的能力。作为光伏组件重要组成部分，光伏接线盒和连接器由于露天使用，经常处于十分恶劣的天气与环境中，因此要求具有较高的电气安全性、电气保护功能稳定性和机械结构稳定性、良好的耐候性和密封防水性，高电流高压承载性等性能。公司为提高产品竞争力，注重研发费用投入，近 3 年研发投入占销售收入比为 4.9%。

Founded in 2012, CleanTech Co. focuses on the electrical protection and connection of PV modules and PV power stations, mainly engaged in the R&D, production and sales on series products of PV junction box and connector. PV junction box and connector are the "control center" of PV battery modules (Figure 6), they belong to the midstream of photovoltaic production chain. Although they only cost less than 3% of battery module components, their safety is quite important. The company has won the title of National High-tech Enterprise in 2018, with the ability to provide customized service on R&D and production of core accessories for major PV module manufacturers. As an important part of PV module, PV junction box and connector are used in open air, and frequently exposed to severe weather or environment. Therefore, they consist of many key properties including: higher level electrical safety; stability on electrical protection and mechanical structure; better weather fastness, sealing and waterproofing; sufficient carrying capacity to high current and high voltage, etc. To improve the competitiveness for its products, the company focused on R&D investment, which accounted for 4.9% of the revenue in the past three years.

图 6：接线盒、连接器工作示意图

Figure 6: working diagram for PV junction box and connector



四、 公司经营目标实现遇到的困难（案例问题）

Difficulties in achieving business objectives (case questions)

朱峰（Daniel.Zhu）在 2022 年 7 月举行的经营分析会&半年度预算总结会上了解到，采购部门尚未完成年初下达的降本目标，同时销售部指出，本月发货的产品由于包装盒损坏造成退货量猛增，经质量部检查认定是由于达利公司提供的纸箱硬度未达标造成，采购部解释引入供应商达利公司是严格按照公司采购比价制度操作的，提供的原材料价格比原供应商天昇公司价格下降 5%，且账期可延长 30 天。会议上就更换供应商责任问题争论不休，朱峰（Daniel.Zhu）要求采购部就此事件进行调研，并安排李明（Frank.Li）协助采购部分析退货事件以便在下月经营分析会上汇报。

In July 2022, at the meeting concerning business analysis&summary of semi-annual budget, Daniel. Zhu learned that the procurement department has not completed the cost reduction target issued at the beginning of the year. At the same time, the sales department mentioned that the return volume of shipped products increased rapidly this month due to the damage of the packaging box, and the inspection by the Quality Department confirmed the reason: the carton hardness provided by Dali Company was not up to standard. The Procurement Department explained that the application of supplier Dali Company was conducted in strict accordance with the company's system of purchase price comparison. Their price of raw materials provided was 5% lower than that of the original supplier Tiansheng Company, and the accounting period could be extended for 30 days. At the meeting, they entered into endless arguments on the responsibility of replacing suppliers. Daniel Zhu asked the Procurement Department to investigate the event and arranged Frank Li to assist them in analyzing so that he can report the foundings at the next business analysis meeting.

1) 李明（Frank.Li）深入了解到，年初下达的采购降本目标已纳入采购中心绩效考核指标，采购部自降本工作开展以来严格执行“三家以上供应商比价”，并以“采购价格最低、付款条件最好”做为供应商选择标准。李明（Frank.Li）认为采购部的采购理念是“操作性采购”，需要向“战略性采购”转变，请你结合纸箱事件，解释什么是“操作性采购”，什么是“战略性采购”？并比较两者主要工作内容。
   Li Ming (Frank. Li) learned that the procurement cost reduction target issued at the beginning of the year has been included in the KPI of the Procurement Center. Since the implementation of the cost reduction, the Procurement Department has strictly implemented the "price comparison among more than three suppliers", and the supplier selection criteria was set as "the lowest procurement price with the best payment terms". Frank. Li believes that the procurement concept of the Procurement Department is "operational procurement" and needs to be changed to "strategic procurement". Please explain what is "operational procurement" and what is "strategic procurement" concerning the carton case? And compare their main work contents.

2) 李明（Frank.Li）计划帮助采购部建立采购模型，以辅助采购部进行供应商选择决策，请你列出“战略性采购”对应的采购总成本包括哪些？请从成本性质、成本大类、成本项、成本项说明依次分解列出。（如针对材料运费，需列出成本性质为显性成本、成本大类为供应链成本、成本项为运费、成本项说明为运输单价×数量×距离）
   Frank. Li plans to help the Procurement Department establish a procurement model to assist them in making supplier selection decisions. Please list the total procurement costs corresponding to "strategic procurement". Please breakdown and list the cost nature, cost category, cost item and cost item description in order. (take material freight as an example, the cost nature is explicit cost, the cost category is supply chain cost, the cost item is freight, and the cost item description is transportation unit price × quantity × Distance)

3) 采购部运用李明（Frank.Li）提供的“采购总成本”模型将天昇公司和达力公司提供的原材料采购总成本进行对比，发现达利公司虽然材料报价比天昇便宜，但是采购总成本比天昇公司高。采购部提出单靠比价降本很难完成年度降本目标，希望李明（Frank.Li）能提供一些降本思路。李明（Frank.Li）通过向先进企业学习采购降本方法后意识到，通过深度分析再辅以一些有效的降本手段，降本工作才能有的放矢。李明对材料采购情况进行了调研，发现以下问题：
   The Procurement Department uses the "total procurement cost" model provided by Frank Li to compare the total procurement cost of raw materials provided by Tiansheng and Dali. It is found that although Dali's material quotation is cheaper than that of Tiansheng, their total procurement cost is higher than that of Tiansheng. The Procurement Department proposes that it is difficult

to achieve the annual cost reduction goal by price comparison alone, and hopes that Frank Li can provide some ideas for cost reduction. After learning the cost reduction method from advanced enterprises, Frank Li realized that the cost reduction work can only be targeted through in-depth analysis and some effective cost reduction measures. Li Ming investigated the material procurement and found the following problems:

① 部分标准件存在小批量多供应商订购情况，如线束护套 2021 年分别在 8 家供应商有过采购记录，采购价格根据订单量大小高低不一；

Some standard parts are ordered by small batches with multiple suppliers. For example, the harness sheath has been purchased from 8 suppliers in 2021, and the purchase price varies according to the order quantity;

② 供应商晴天制造公司负责部分外协件壳体的加工，技术质量等能力均在外协供应商前列，是公司重要的外协件供应商，2021 年由于其加大自动化设备更新范围，报价比其他供应商偏高；

The supplier Sunny Manufacturing Company is responsible for the processing of some outsourcing parts shell, its technical quality and other capabilities are in the forefront of outsourcing suppliers, it is an important outsourcing part supplier of the company. In 2021, due to its expansion of the scope of automatic equipment update, the quotation is higher than other suppliers;

③ 设计部负责产品设计并与客户技术部门对接，报价后客户单位还会经常要求变更设计图纸，设计部为配合客户单位尽快完成设计，并不会详细记录变更内容；

The Design Department is responsible for product design and interfacing with the customer's technical department. After the quotation, the client will often request to change the design drawings. In order to cooperate with them to complete the design as soon as possible, the Design Department will not record the changes in detail;

④ 市场部在报价中发现，部分竞争对手报价低于我方报价 10%，后技术部通过对标分析发现，该公司某型号接线盒克重比我公司低 20%；

The Marketing Department found that the quotation of some competitors was 10% lower than that of our company. After the benchmarking analysis, the Technology Department found that the weight of a certain type of junction box of the company was 20% lower than that of our company;

⑤ 2021 年以来，主要原材料塑料粒子受市场环境影响，价格一直上涨，采购部集体商议认为未来还会保持上涨趋势，2021 年 10 月计划申请一次性大量囤货；

Since 2021, the price of plastic particles, the main raw material, has been rising due to the impact of the market environment. The Procurement Department has collectively discussed that it will maintain the rising trend in the future. In October 2021, they planned to apply for a large amount of stock at one time;

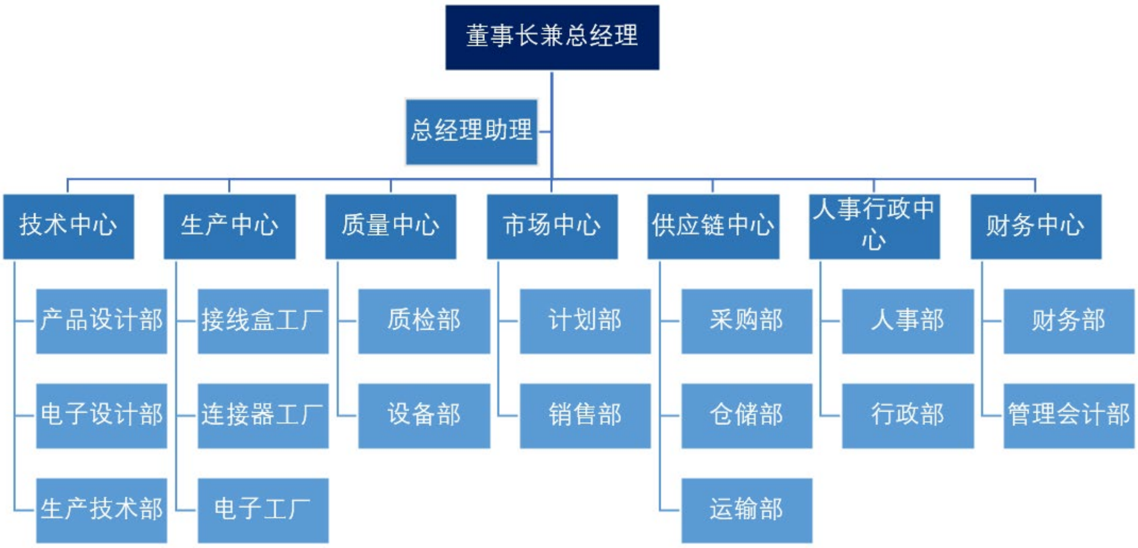
⑥ 由于疫情和国际形势紧张，主要原材料二极管采购周期不稳定，2021 年 8 月采购部以避免缺货损失为由，申请一次性大量囤货。

Due to the epidemic situation and the tense international situation, the procurement cycle of main raw material diodes is unstable. In August 2021, the Procurement Department applied for a large amount of stock at one time to avoid the loss of shortage.

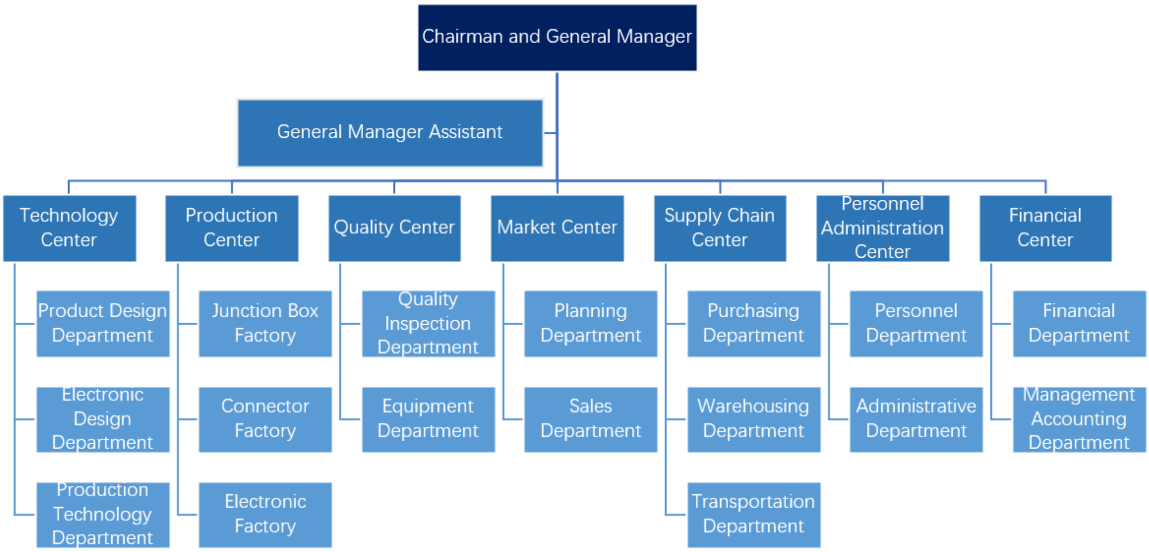
请你从李明调研采购现状中挑选出至少 3 个例子，分别从业务手段、管理手段、技术手段 3 个方面帮助李明出谋划策，找出哪些方法可以帮助采购部降低采购总成本。

Please select at least three examples from Li Ming's research on the current procurement situation, and help Li Ming to make suggestions from three aspects of business means, management means and technical means, and find out which methods can help the Procurement Department reduce the total procurement cost.

附件 1：清洁光伏公司 2021 年组织架构图



Annex 1: Organization Chart of CleanTech Co. in 2021



附件 2：清洁光伏公司 2021 年预计报表
Annex 2: Estimated Financial Statements of CleanTech Co. in 2021

预计资产负债表 Estimated Balance sheet

单位名称：清洁光伏科技有限公司 Company Name: Clean Photovoltaic Technology Co., Ltd.

所属时期或截至时间 Period or Deadline： 2021.12.31

单位：万元 Unit: Ten Thousand Yuan

资产 Assets	期初数 Beginning Balance	期末预计数 Estimated Ending Balance
流动资产 (Current Assets)	**37,344**	**53,938**
现金 (Cash)	4,703	6,101
应收票据及应收账款 (Notes and Accounts Receivable)	23,439	36,469
其他应收款 (Other Receivables)	108	140
预付账款 (Prepayment)	51	74
存货 (Inventory)	7,539	10,028
其他流动资产 (Other Current Assets)	1,504	1,126
非流动资产 (Non-current Assets)	**7,002**	**6,952**
长期投资 (Long-term Investment)	–	–
固定资产 (Fixed Assets)	5,032	4,989
无形资产 (Intangible Assets)	780	490
其他非流动资产 (Other Non-current Assets)	1,190	1,473
资产总额 (Total Assets)	**44,346**	**60,890**
流动负债 (Current Liabilities)	**18,821**	**30,238**
短期借款 (Short-Term Loan)	1,200	1,200
应付票据及应付账款 (notes payable and accounts payable)	12,281	22,695
其他流动负债 (Other Current Liabilities)	5,340	6,343
非流动负债 (Non-current Liabilities)	–	–
长期借款 (Long-Term Loan)	–	–
其他非流动负债 (other Non-current Liabilities)	–	–
负债合计 (Total liabilities)	**18,821**	**30,238**
股本 (Capital Stock)	5,000	5,000
资本公积 (Capital Reserves)	–	–
留存收益 (Retained Earning)	20,525	25,652
股东权益 (Shareholder's equity)	**25,525**	**30,652**
负债和股东权益 (Liabilities and Shareholder's equity)	**44,346**	**60,890**

清洁光伏科技有限公司预计利润表
Estimated Income statement of CleanTech Co.

单位：万元
Unit: Ten Thousand Yuan

资产 Assets	1月1日-9月30日实际 Jan.1 – Sep.30 Actual	10月1日-12月31日预计 Oct.1 – Dec.31 Estimated	2021年全年预计数 Estimated number of the whole year in 2021	2020年全年数
营业收入 Operating Revenue	41, 039	17, 120	58, 159	46, 034
营业成本 Operating Cost	32, 694	13, 890	46, 584	35, 860
毛利润 Gross Profit	**8, 345**	**3, 230**	**11, 575**	**10, 174**
税金及附加 Taxes and Surcharges	110	49	159	198
营业费用 Operating Expense	809	198	1, 007	903
管理费用 Administrative Expense	978	389	1, 367	1, 238
研发费用 R&D Expense	2, 089	821	2, 910	2, 198
财务费用 Financial Expense	139	29	168	164
营业利润 Operating Profit	**4, 220**	**1, 744**	**5, 964**	**5, 473**
营业外支出 Non-Business Expenditure	20		20	230
利润总额 Total Profit	**4, 200**	**1, 744**	**5, 944**	**5, 243**
所得税 Income Tax	578	239	817	754
净利润 Net Profit	**3, 622**	**1, 505**	**5, 127**	**4, 489**

附件 3：清洁光伏公司主要财务指标

Annex 3：Table of main financial indicators of CleanTech Co.

指标名称 Indicators	清洁光伏 CleanTech Co.			领先光伏 LingXian PV	明熙光伏 MingXi PV
	2019	2020	2021	2021	2021
一、获利能力分析 Profitability Analysis					
1、权益净利率 Return On Equity (ROE)	18.79%	19.28%	18.25%	18.84%	24.87%
2、毛利率 Gross Profit Margin	24.30%	22.10%	19.90%	18.70%	23.00%
3、销售净利率 Net Profit Margin on Sales	8.92%	9.75%	8.82%	7.90%	10.90%
4、总资产收益率 ROTA	10.44%	11.95%	9.74%	10.35%	15.26%
二、短期偿债能力分析 Analysis of Short-term Solvency					
1、流动比率 Current Ratio	2.55	1.98	1.78	1.61	1.88
2、速动比率 Quick Ratio	1.91	1.50	1.41	1.22	1.53
3、现金比率 Cash Ratio	0.25	0.25	0.20	0.12	0.23
三、长期偿债能力分析 Analysis of Long-term Solvency					
1、资产负债比率（期末值） Asset-Liability Ratio (Endling Balance)	31.65%	42.44%	49.66%	45.41%	39.89%
2、权益乘数(平均值） Equity Multiplier (Average Value)	1.80	1.61	1.87	1.82	1.63
四、资产管理效果分析 Analysis of Assests Management Effect					
1、总资产周转率 Total Assets Turnover	1.17	1.23	1.11	1.31	1.40
2、应收账款周转率 Receivables Turnover	2.30	2.33	1.94	2.42	3.12
3、存货周转率 Inventory Turnover	5.40	5.68	5.30	4.91	5.78
4、固定资产周转率 Fixed Assets Turnover	8.56	9.73	11.61	10.38	9.43
5、其他非流动资产周转率 Other Non-current Assets Turnover	39.36	43.02	43.68	44.39	43.98
6、应付账款周转率 Accounts Payable Turnover	2.30	3.37	2.66	2.42	2.23
五、成长性分析 Growth Analysis					
1、收入增长比率 Revenue growth rate	25.77%	24.82%	26.34%	38.02%	48.11%
2、总资产增长率 Total asset growth rate	-4.61%	44.09%	37.31%	16.40%	80.36%
3、净利润增长率 Net profit growth rate	12.20%	36.44%	14.21%	16.33%	20.16%

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