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New Rec: Capstone Turbine (CPST-$26.18) Feb. 19, 2001

Position: Sell Target: $13.50 Timing: 2 (1=aggressive; 5=cautious)

$000	Q400A	Q101E	Q201E	Q301E	Q401E	F00A	F01 E	F02 E
Rev.	7,134	8,772	11,135	14,453	18,930	23,163	53,290	114338
EPS $	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)	(12.82)	(0.30)	(0.17)
YYGro	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
PSR					108	88	38	18
CnsEPS		(0.08)	(0.05)	n/a	n/a	n/a	(0.19)	0.22
CnsRev							92,763	251923

Shares Out: 75.94M Mkt. Cap: $2B FYE: Dec.

Summary: Capstone Turbine manufactures and sell micro-turbines mainly for distributed power generation applications. Capstone was founded in 1988. Capstone sells units in two sizes, 30kw and the recently introduced 60kw unit.

To its credit, compared to some other distributed energy solutions, Capstone actually ships a commercial unit. The company sold its first commercial unit in 1998, and sold 790 units in calendar 2000, including about 8 60kw units. The fact that the company actually has a commercial unit with sales has made it a more attractive investment than some of the other players in distributed energy.

Nevertheless, it does not appear that the technical limitations of the unit have been well understood by investors. The major limitation, from our point of view is poor load following capability. This means that the unit is not suitable for applications where the power demanded form the unit is frequently changing, which includes most applications where the grid would not be present. Other limitations include slow start-up, high capital costs due to expensive power electronics and other expensive components, high maintenance costs and high fuel costs.

Due to the high over all cost of using the Capstone turbine, which we discuss, almost no-one seriously argues that the unit is competitive with the grid in any but a couple of isolated locations. Our own research indicates that the only places that the unit might compete with the grid is in Alaska in certain industrial settings and in Bolivia. As a result, bullish investors must argue that there are enough other markets for Capstone’s solution to allow it to grow into its current $2 billion market capitalization. These markets are identified as micro-cogeneration, hybrid electric vehicles, stand-by power and peak shaving, and resource recovery. The company and analysts estimate that sales will be spread about evenly between these markets. However, in our view only the resource recovery market is a truly viable market for Capstone turbines due to their high cost and their technical limitations. The reason that the resource recovery market makes more sense for Capstone is that fuel is free, making the unit's economics more attractive.

We examine each of these markets in detail and we explain why the unit is not suitable for these applications in most cases. We then study the resource recovery market, and how the unit might be used in that application.

We conclude that Capstone will not be able to meet analyst expectations of 3,000 units sold in 2001 for revenue of about $100M, and over 8,000 units sold in 2002 for revenue of about $250M, and for at least 16,000 units up to 20,000 units sold in 2003 for revenue of about $500M or more. We conclude that Capstone will be fortunate if it can meet just 50% of the "street's expectations for sales in the years 2001 and beyond. We think even our estimates for revenue of $50M in 2001, $100M in 2002 and $200M in 2003 are aggressive. The reason is that the the co-generation, electric vehicle and stand-by power/peak shaving markets are smaller than estimated by the "street", and they will grow more slowly than expected. The resource recovery market should grow more rapidly, but it is still a much smaller market than hoped for, as we discuss in detail below.

Recently two events have conspired to drive Capstone's share price from its high of about $55 during the height of California energy hysteria earlier this month to its current share price of $26, where it had been in December 2000. First, Capstone reported relatively unimpressive results for Q4 00, as we discuss later. Backlog declined in Q4 from Q3, and shipment of the 60kW unit were behind schedule. Second, there has been added pressure on the shares from the release of about 52M shares of CPST previously locked up. Of course, many of these shares had been previously sold by investors, in effect, by selling short these shares well prior to the end of the lock-up. Nevertheless, there was substantial additional pressure on February 15 when the lock-up expired. Another 8M shares will be unlocked on about May14.

Capstone has market capitalization of $2 billion, which we think should be at least cut in half as investors see additional results, and as the true size of the market for microturbines is understood, and as the hysteria from the California power crisis diminishes.

Discussion:

Background:

Capstone’s microturbines are small, coming in a 30kW unit and in a recently introduced 60kW unit. The units are intended to run 100% of the time, and provide primary power.

The world-wide market for power generation can be divided into types of generation: nuclear, hydro, steam turbines and combustion-type systems. Combustion systems is about an $11B market and is split about equally between traditional gas turbines, and reciprocating engines. For applications below 1 MW, the reciprocating engine dominates and has virtually 100% of the market, which makes it the dominant incumbent technology the microturbine must displace. Applications below 200 kW represent about 37% of the market for reciprocating engine generators, or about $2B.

The reciprocating engine market as a whole may be further subdivided by application as follows: standby: 61%; peaking: 12%; and prime: 27%. As we will explain, the microturbine is technologically most suited to operate in a baseload (prime power) capacity. Thus, we estimate the market for primary power applications less than 200kW is about $500M, growing about 10% per year. In our view, given the technology, this is the market opportunity for which Capstone competes.

I. Capstone's microturbines have technical limitations that do not appear to be well understood by investors.

1. Slow startup: The CPST microturbine takes several minutes to start up and requires either that utility power, or a substantial battery be available to initiate start up. The external power source drives the unit’s motor to spin the turbine to about 12,000 revolutions per minute (rpm). Around this speed, ignition can take place and the unit can take over on its own and accelerate to full power of 96,000 rpm.

2. Expensive power electronics needed: Because of the extremely high rotational rate of the unit, the electrical output from its generator is at 1600 Hz, and must be reduced to useable 50 or 60 Hz using power electronics similar to those found in an uninterruptible power supply (UPS). These power electronics cut efficiency and are expensive, representing a cost burden which incumbent reciprocating engine technology does not bear.

3. Microturbine technology is unsuitable for stand alone/load following and is therefore mainly suited for baseload generation, which limits its market.

The microturbine is not technically suited for applications where the power demanded is frequently changing, such as in a stand alone application where the grid is not present. CPST's US Patent 6,031,294 summarizes this fundamental technological limitation:

"A gas turbine, however, inherently is an extremely limited thermal machine from a standpoint of its ability to change rapidly from one load state to a different load state. In terms of accepting an increased loading, the gas turbine has a limited capability of adding probably two (2) kilowatts per second; in other words, being able to accept full load in a fifteen (15) second period. The reality for stand-alone systems is that the application of load occurs in approximately one one-thousand of a second."

"In terms of off-loading, the gas turbine has similar limitations if there is a rapid off-loading of power. When operating in a self-sustained manner, the gas turbine has a very large amount of stored energy, primarily stored in the form of heat in the associated recuperator. If the load were removed from the gas turbine, this stored energy would tend to overspeed the turbine."

This limitation confines the microturbine's optimal operation to baseload generation. This conclusion is confirmed by industry sources who tell us that the microturbine is intended to run flat out, at 100% capacity. As CPST's CEO also put it in a conference call "they like to run."

Load following is not only problematic for individual microturbines, but also for multiple units configured into a "multi-pac" group. For example, even when trying to operate in a grid-parallel mode without using any grid power, the "multi-pac" still relies on the grid in order to supply the variable component of the load.

Without the grid present the microturbine/multi-pac must sacrifice efficiency in order to improve its load following ability. CPST patent 6,169,334 explains the problem of load following by a multi-pac:

"Automatic load following is a control mode in which the Multi-Pac supplies the entire load and maintains the utility contribution at zero. Load transients in this control mode have a large impact on the output of the total system. Sudden decreases in load cause the system to back feed onto the utility grid for a short time until the Multi-Pac energy can be dissipated. Rapid increases in load require the utility grid to supply power for a short time until the Multi-Pac power output can be met. This constant changing in power demand can greatly reduce the operating efficiency of the entire system."

"If rapid transient response is required," [as, for example, in a true stand-alone application where grid power is not available] "one or more turbogenerators may operate in idle or standby, ready to deliver power at any instance in time. While this control strategy sacrifices efficiency over availability, it does provide better response times to increased loads."

Furthermore, industry sources report that by themselves it is particularly problematic for microturbines to start up equipment like motors and air conditioners. This is because the microturbine has problems supplying the extra "reactive power" such equipment draws during startup.

II. Capstone's microturbines have cost limitations as well.

1. Capstone microturbines are not competitive with the grid. Since the

microturbine is technologically suited mainly to provide continuous baseload electricity in conjunction with the grid, in order to justify itself, the cost of microturbine electricity needs to be lower than the cost of grid power. The continuous baseload market for Capstone would mainly be industrial utility customers. These users consume enough electricity to be able to fully harness the baseload power of a single 30 kW microturbine. However, of the US states, and countries we examined, only in Alaska and Bolivia might an industrial customer realize a small 12% and 3% cost savings over the utility respectively. Even bullish analysts who follow Capstone concede this lack of competitiveness with the grid.

The average residential and commercial utility customer doesn't consume enough electricity to justify the capital expense of a microturbine. In 1999, average US residential and commercial customers consumed about 866 kWhrs and 5792 kWhrs respectively. However, the 30 kW CPST unit can produce 21,900 kWhrs/month of baseload electricity. Thus, the average residential and commercial customer would be able to utilize no more than 4% and 26% respectively of a 30 kW CPST unit's total baseload capacity. This means a far higher cost of capital/kWhr generated. Secondly, if the unit is operated below its maximum 30 kW baseload output, then the unit efficiency drops, which will increase the already-high fuel cost per kWhr of the CPST unit.

By contrast, the average industrial utility customer in the US consumes 160,839 kWhrs/month. Since this is seven times the full capacity of a single CPST unit, the industrial customer would more likely be capable of harnessing the full round-the-clock baseload capacity of at least a single 30 kW CPST unit. However, as will be seen, the CPST unit is not competitive with the grid for either industrial or commercial utility customers.

2. Fuel costs are high for Capstone. Even under its optimal operating conditions the microturbine has very low electrical efficiency of only 27% (on a lower heating value basis.) By comparison, large, megawatt-scale combined cycle gas turbine plants can realize 58% electrical efficiency. Their low efficiency is one of the biggest handicaps for the microturbine as it results in high fuel consumption, and therefore high fuel cost. By comparison, small natural gas reciprocating engine generating sets can have 30% better efficiency than the microturbine.

For 1999, the average commercial and industrial rate for electricity in the US was about 7.2 and 4.36 cents/kWhr respectively and the rates are about the same in 2000. Using the 1999 average commercial and industrial price of natural gas of $5.23 and $2.98/MMBtu respectively, the fuel cost alone for CPST's microturbine would be 7.3 and 4.2 cents/kWhr for commercial and industrial users respectively. This is already about equal to the grid rate and ignores the additional cost of the microturbine, installation, maintenance and any administrative time costs and distractions a buyer must devote toward generating its own electricity.

Furthermore, wholesale natural gas prices as per the Henry Hub benchmark price have shown a dramatic secular rise to $5.40/MMBtu as of this writing from a stable $2/MMBtu in the past. Assuming distribution charges to commercial and industrial users stay fixed at about $2.30 and $0.60/MMBtu respectively, their final cost of natural gas could eventually migrate to $7.70 and $6/MMBtu respectively . This would increase the commercial and industrial fuel cost for CPST microturbine electricity to 10.9 and 8.5 cents/kWhr respectively. This is already 50% and 100% higher than their cost of grid electricity respectively, and does not include capital costs or maintenance.

3. Capital and maintenance costs are high. On page 33 of CPST's 11/6/00 prospectus, CPST provides an estimate of what it would cost to run its microturbine in a resource recovery application. Since fuel is free in these applications, we take this to be an estimate by CPST of the cost of capital and maintenance. CPST states:

"Assuming the units are grouped in operating groups of four and run approximately 90% of the year, we estimate the generation cost per kilowatt hour at slightly less than 4.7 cents/kWhr."

While 4.7 cents/kWhr for cost of capital plus maintenance is actually somewhat lower than our own estimates, when we add this 4.7 cents/kWhr to the fuel cost for different states and countries (see Appendix), we discover that only in Alaska and Bolivia could industrial users expect a small savings of 12% and 3% over the grid respectively.

Moreover, CPST's estimate of 4.7 cents/kWhr is 17% higher than what CPST had estimated for the same application 5 months earlier in its 6/28/00 IPO prospectus. Since CPST's selling price has actually decreased slightly, this suggests that as CPST gains experience running its units for longer periods of time, it may be finding the units more expensive from a maintenance point of view. This fits with our analysis, given below, which shows that CPST's cost per unit to service warranties has been increasing.

Our calculations also assume the CPST unit is run under optimal baseload conditions, i.e. at sea level and when temperatures are below 59 degrees F. However, if the temperature is higher than 59 F which is quite likely especially in summer months and in southerly climates, then the unit de-rates. Total output drops about 1 kW per 7 degrees F above 59F, and efficiency drops about a percentage point every 14 degrees F above 59 F.

The maximum output on a 30 kW unit also drops about 1 kW for every 1300 ft above sea level.

III. As a result of its technical and cost limitations, Capstone's market opportunity is limited.

1. By virtue of geography, Alaska is shielded from the rise in natural gas prices experienced in the lower 48 states. However, even if industrial utility customers in Alaska could be convinced to self-generate a portion of their demand, the market for CPST is small. In 1999 there were only 473 industrial utility customers in Alaska. About 96,000 kW of generating capacity could completely satisfy their demand. If CPST could penetrate 5%/yr of this potential market, it would only amount to about 4800 kW/yr, or about $4.8MM/yr for CPST assuming a sales price of $1000/kW. (about 160 of CPST's 30kW units/yr.)

2. Resource Recovery is a real market for Capstone. Because of the unit's low efficiency, we think the most promising market for the microturbine is in "resource recovery" situations where a free source of fuel is available. During the Q4 conference call, CPST management confirmed that resource recovery is its strongest segment.

Flare & Vent Gas**:** The most prominent early resource recovery markets for CPST has been to use the microturbine to burn otherwise flared "solution" gas, or vented casing gas in the province of Alberta, Canada. Early users there were Pan Canadian Petroleum and Fletcher Challenge Energy Canada.

Solution gas comes out of the oil after it is extracted. Some flared "solution" gas may contain various levels of sulfur content, and is termed "sour gas." "Sour gas" is highly corrosive and extremely poisonous, which partly explains why it must be flared if it cannot be economically processed for sale.

CPST's 30 kW microturbine can burn sour gas, which is an advantage over reciprocating engine generators which corrode very quickly when burning sour gas. However, CPST's new 60 kW unit, on which much of the "street's" revenue growth for FY01 is based, might not share this ability. On page 42 of CPST's 11/6/00 prospectus CPST explains that it expects much of the functionality available in the 30 kW Model 330 unit "also to be available with our new 60 kW family of microturbines, except for the capability to operate on sour gas, about which we are uncertain."

While the microturbine may be able to burn corrosive "sour" flare gas, we understand from distributors that the fuel compressor component of the microturbine will still have trouble handling sour gas and will wear out much more quickly on sour gas.

In CPST's Q2 00 conference call, CPST pronounced that there were 25,000 flare stacks in Alberta alone, implying this could be an enormous market. However, a single 30 kW CPST microturbine at full output consumes gas at a rate of about 100,000 cubic meters (m^3) per year. Unfortunately for Capstone, only about half the flares in Alberta flare this much gas per year, and even for very large flares the flow rate may be highly variable and even intermittent.

A 1998 paper titled "An Evaluation of Potential Technologies for Reducing Solution Gas Flaring in Alberta" prepared for Alberta's Clean Air Strategic Alliance Flaring Project Team, estimated that there were potentially 700 sites where microturbines could be used to recover a total of 27% of the Provincial solution gas flaring volume.

According to Alberta's 1999 "Upstream Petroleum Industry Flaring Report," 938 million m^3 of solution gas was flared in crude oil and bitumen batteries in the province in 1999. 27% of this amounts to 253 million m^3 of solution gas, which could be burned by a total of just 2412 of CPST's 30 kW units.

Another source of "free" gas emitted from oil wells in Alberta is vented casing gas from crude bitumen batteries. This gas is termed "sweet" rather than sour and is of high (saleable) quality, although it does contain water. Casing gas can be burned by reciprocating engine generating sets. Vented casing gas in Alberta amounted to 459 MM m^3/yr in 1999, 27% of which could be burned by 1180 of CPST's 30 kW microturbines.

Combining flare and vent gas volumes, the entire potential addressable market for CPST's 30 kW microturbines in Alberta amounts to only about 3600 units.

Another problem with this market is that the volume of gas flared and vented in Alberta has been declining steadily since 1993, declining 11.8% in 1999 alone. Further, we understand from industry sources that the more than doubling in natural gas prices over the past year will contribute significantly toward reducing flare and venting volumes as the economics of collecting otherwise uneconomical gas and piping it to processing centers has dramatically improved. Industry sources also tell us that if oil companies must make an investment to reduce flare and vent gas volumes, they would prefer to undertake a project to sell the gas rather than sell electricity since they are in the oil and gas business, not in the electricity business.

Alberta Flare gas volumes:

Year	Solution gas conserved %	Flared & vented (million m^3)	Flared & vented (% change)
1,993	90.2%	2,016	
1,994	91.1%	1,924	-4.6%
1,995	91.3%	1,919	-0.3%
1,996	92.0%	1,808	-5.8%
1,997	92.7%	1,658	-8.3%
1,998	93.3%	1,583	-4.5%
1,999	94.1%	1,396	-11.8%

In addition to Alberta, the Wyoming market may be interesting. In the US, about 6845MM m^3/yr of gas is vented and flared, with Wyoming accounting for about 58% of the total, or about 4000 m^3/yr. While CPST has been selling units into Wyoming, industry sources tell us the majority of the units aren't being operated using the flare/vent gas as fuel. Rather, we are told that the majority of the CPST units in Wyoming are being used to provide on-site power for new coal-seam gas wells, where they operate using some of the coal seam gas produced for sale. Further, we understand the vast majority of these sites are just renting the microturbine in the interim until they build connections to the grid. We think about 150 microturbine units are presently being used in this manner.

Thus, microturbine demand, even in Wyoming, rather than being driven by the large volume of gas flared and vented in the state, appears to depend on the rate of growth in drilling for coal seam gas deposits in the state. Once the growth rate in new coal seam producing sites which come online each quarter slows, demand for new microturbine units from CPST could fall significantly, as the number of units removed from older sites which become grid-connected starts to balance the rental demand from new sites coming online.

The flare gas market also poses additional maintenance problems for Capstone. While the microturbine may need less frequent maintenance, the maintenance appears to be quite specialized and may therefore require specially trained personnel to come from far away. For example, we understand that in many instances oil batteries are in remote locations and are maintained under service contracts with local farmers who are well versed in maintaining reciprocating engines, but who would not be versed in maintaining microturbines.

Another limiting factor is that without the grid available, the suitability for using the microturbine will depend on the nature of the electrical equipment to be operated on-site. For example, a “pump-jack,” which is common equipment at oil sites, under certain circumstances will feed electricity back from its electric motor to the site’s electric system. However, the microturbine cannot accept this power and its power electronics can be fried under this circumstance.

We also understand that microturbines may have trouble as a stand alone device in starting up motors. This is because the microturbine has poor ability to supply the extra “reactive” power needed to start up motors, which typically draw several times more power than the nominal “real” power consumed during continuous motor operation. We have been told by industry sources that this shortcoming contributed to one of CPST’s early distributors in Alberta dropping CPST.

The composition of flared solution gas can also present problems for a microturbine. For example, the microturbine cannot accept both liquid and gaseous fuel simultaneously – the liquid will “take out” the microturbine. This becomes a problem if propane or butane is present in the flare gas, and if conditions are such that this gas might condense prior to being fed to the microturbine. In this event extra precautions are needed.

Flare gas may also be subject to rapid and random changes in fuel composition which the microturbine may not be able to accommodate.

Producing electricity from oil batteries has other practical problems. If the oil battery is close enough to connect to the grid, then the microturbine isn’t needed for on-site power. Conversely, if the facility cannot itself use all the electricity which its flare gas could produce, then it needs to be close enough to the grid in order to export the excess. However, selling excess power to the utility involves a whole host of separate issues and requires finding a buyer for the power at acceptable prices.

Reciprocating engine generators are a major, established competitor for burning waste gas. They can also be used for onsite power needs running off of casing gas. For example, an 80 kW General Motors natural gas engine can be had for about $20,000, or about $250/kW, which is a quarter to a third the per-kW cost of a CPST microturbine. We also understand that some customers will even run a reciprocating engine from “sour” gas, and simply replace components much more frequently than normal.

We estimate that CPST had sales of about 1,800 kW of microturbines (or about 60 30 kW units) in this segment in Q4. Our own revenue projections, which we view as optimistic, see this as CPST's strongest growth segment going forward, with quarterly sequential kW sales growth of about 60% for 2001, slowing to 20%-40% in F02 and F03. We also project that an increasing fraction of CPST's total kW sales will come from its new 60 kW product, starting at 15% in Q1 01, adding 5 percentage points a quarter thereafter. Our estimated ASPs on the 30 and 60 kW units in Q4 00 are $29,000 and $43,500 and we project these to decline by about 2% each quarter. We project total unit shipment in 2001 of about 1800 units, slightly below the low end of management guidance.

3. The cogeneration market, combined heat and power (CHP,) is a small market. This application attempts to overcome the microturbine's low efficiency by using the unit's exhaust heat to provide hot water, space heating, or other applications. The first problem with this is that expensive extra heat exchange equipment is needed in order to accommodate this function, which we are told can add $200-$300/kW to the cost of the base microturbine.

The second problem is that a user can only generate heat when also generating electricity. Since grid power is cheaper, a user needs to more than make up the loss from not buying from the grid with the savings realized from not buying fuel for a dedicated heating device such as a boiler or furnace.

CPST claims that with heat recovery, the overall efficiency can rise to 60%-70%. However, a dedicated hot water heater can be 85% to 90% efficient at converting the energy in its fuel into hot water, and the equipment costs are lower than the microturbine add-on.

The savings realized by utilizing the heat from the microturbine can reduce the effective cost of the fuel for the unit by about 50%. This still does not arrive at a fuel cost sufficiently low to interest an industrial user.

Japan in particular has been a target market for the CHP-microturbine. However, even with an offset 50% fuel cost savings, industrial users in Japan become only break-even with the grid. By our estimate, only industrial users in the following locations would realize an over 10% savings versus the grid under using a CHP-microturbine: US: Alaska (+24%), New Hampshire (+14%), New Jersey (+10%); Internationally: Argentina (+12%), Bolivia (+18%), Colombia(+17%), Italy(+10%) and Switzerland(+10%)

This 50% fuel savings also assumes ideal conditions. However, if 100% of the waste heat is not needed 100% of its operating time, which seems likely in many cases, then the heating-fuel cost savings are reduced. Also, while the microturbine runs from natural gas, if the heating fuel available is a lower-cost fuel, then this too will cut the heating-cost savings. It also may be that users would not want to link the reliability of their heating supply to the reliability of the microturbine, and may therefore want to have back-up heating equipment anyway. But if dedicated heating equipment is at hand, why buy the microturbine?

It is interesting to note that while CPST must rely on others to develop CHP equipment for use with the Capstone unit, ABB and Volvo are co-developing a 100 kW microturbine designed for specific CHP applications such as hospitals. Turbec, an ABB/Volvo joint venture expects to ship many more units in 2001 than the 20 units it shipped in 2000. The Turbec joint venture is using a different business model, and it is designing units for very specific applications and is directly selling power and heat, as opposed to selling microturbines.

We estimate that CPST sold about 1800 kW into this application in Q4 and we project 20% quarterly sequential growth in 2001 in this application.

4. Electric Vehicle Market is not significant. CPST sells some microturbines for environmentally friendly bus applications. As mentioned earlier, the turbine is technologically not suited for reacting to sudden changes in electric power demand. However, this is exactly what is required for vehicular applications, where rapidly changing power demand associated with acceleration and braking are the norm rather than the exception. The microturbine thus operates in conjunction with batteries to supply electricity for the vehicle's electric drive. The battery range, cost, recharging, and replacement are issues for these buses.

Traditional diesel and even more expensive but environmentally friendly natural gas reciprocating engines offer much more bang for the buck, costing about \$84 and \$205 per kW of mechanical power respectively compared to about \$970 per kW of electrical power offered by the CPST turbine.

In the US, the transit bus market is essentially a replacement market of about 5000 buses per year. While CPST might make some sales as the latest novel environmentally friendly vehicle scheme, it faces an uphill battle to really prove cost competitive in the long haul and to take meaningful market share.

We think this market also accounted for about a quarter of CPST's revenue in Q4 and we project sequential kW sales growth of 20% per quarter going forward.

5. Back-up applications. Even competing microturbine manufacturers have told us that their microturbine unit is not suitable for backup applications, citing slow start-up on the order of minutes as one problem. Since backup units hardly ever actually run, they must compete primarily on the basis of low capital cost. Here, diesel reciprocating engine generators have the clear advantage, costing a third as much on a \$/kW basis as a microturbine.

We estimate CPST's Q4 sales for backup and power quality are very low at only about 10% of Q4 sales, and project only 5% sequential quarterly kW sales growth from this segment.

6. Peak Shaving. The notion of peak shaving is that a grid customer with a variable rate structure will use a microturbine to generate power only when the grid power cost is higher than the cost of generating with a microturbine. However, the less the microturbine is operated (low utilization), the more important low capital cost becomes and the more attractive a natural gas reciprocating engine generator

set becomes for this application. Industry sources tell us that microturbines face stiff competition from these generating equipment solutions from Waukesha, Caterpillar and Cummins which are aimed at exactly this market. Waukesha offers units in sizes from 170 to 3000 kW. These units have 30% higher efficiency than the CPST microturbine so they can also generate more cheaply. Generac is also coming out with a small 50kW, the DG50, natural gas reciprocating engine generator intended for precisely this kind of application.

We estimate peak shaving accounted for about 15% of CPST Q4 sales, and we project 20% sequential quarterly kW sales growth from this segment in 2001.

IV. Competing microturbine manufactures:

CPST faces competition in its markets from two other microturbine manufacturers whose units are less costly on a per kW basis than CPST's 30 kW unit, which goes for about $970/kW. However, CPST's new 60 kW unit is less costly than the competition at about $725/kW. Honeywell's 75 kW "Parallon" unit costs about $60,000 ($800/kW) with all the options. Elliot is selling a 45 kW unit for about $40,000 ($888/kW) and an 80 kW unit for about $60,000 ($888/kW) and plans to introduce a 200 kW unit. We understand the Elliot units perform well and are competitive with the CPST unit.

Numerous other competitors are on the horizon. Notably, Ingersoll Rand's NREC unit is planning to introduce units in 30 to 250 kW sizes, with a higher efficiency of 33% compared to CPST's 27%. Ingersoll Rand also plans to use a different two-shaft technology to improve load following versus the CPST unit. IR claims its unit will be "better adapted to the rigors of industrial applications than microturbines based on transportation designs (such as CPST's unit). The two-shaft PowerWorks configuration is superior to a single shaft design because the latter forces a compromise between the requirements of the gas turbine engine itself and the needs of a particular load. The free power turbine in our two-shaft design provides unparalleled flexibility in matching to mechanical drive load-following while reducing stress and prolonging engine life."

Pratt & Whitney Canada is developing a 400 kW microturbine based on one of its existing turbo engines and expects it will be commercially available in early 2002. DTE and Turbo Genset (UK) are partners

As discussed previously, ABB & Volvo are developing a 100 kW unit specifically for co-generation (combined-heat and power) applications, and expect to ship many more than 20 units in 2001.

Bowman, a private British company is developing microturbines in a variety of sizes using Elliot's engine. 35 & 60 kW units are apparently available now, with 80 and 200 kW units either here or planned.

Solo energy is developing a 90 kW microturbine and expects to begin beta testing in 2001. Solo's partners are SCANA, and Enron who made a cash investment in the company in August 2000.

In addition, CPST's secondary prospectus states that IHHI and Mitsubishi Heavy Industries in Japan each have in-house development efforts underway.

V. The problem of increasing warranty costs.

CPST itself expects product malfunctions and lower availability as its units are used for longer periods of time. On page 7 of its 11/6/00 secondary prospectus CPST writes:

"…as we develop new configurations for our microturbines or as our customers place existing configurations in commercial use for long periods of time, we expect to experience product malfunctions that cause our products to fall substantially below our 98% availability target level. While our microturbines have often achieved this availability target when using high pressure natural gas, we are still working to achieve this availability target across all of our units and for all fuel sources."

Thus, it seem likely the average cost of maintaining a unit, whether under warranty or not, will increase as CPST's fleet of commercial units in the field ages. This can already be seen in CPST's reported numbers.

As the table below indicates, CPST's actual warranty service cost/unit is already rising, even though the fleet-average unit age going into Q4 was only 6 months. The average age in months in the field of CPST's commercial fleet at the beginning of Q3 and Q4 increased 22% and 25% sequentially while CPST's actual payments/unit/quarter to honor warranty increased 25% and 20% respectively in the same quarters. Actual payments to meet warranty stood at $1,384/unit/quarter in Q4, which works out to about 2.3 cents/kWhr assuming the unit is operated 90% of the time and always at full (optimal) capacity.

The fact that CPST's warranty servicing cost per unit is increasing calls into question whether CPST is now taking large enough warranty reserve charge or whether it plans to push these servicing costs onto customers, which might harm future sales.

In $,000	Q2 99	Q3 99	Q4 99	Q1 00	Q2 00	Q3 00	Q4 00	Q1 01
Accrued warranty res:	1,100	1,283	3,168	4,186	5,572	6,037	5,589	
Chng in accrued warranty reserve:	114	183	1,885	1,017	1,386	465	(448)	
Warranty reserve charge:	202	247	1,978	1,400	1,700	1,100	605*	
Actual cost to service warranty:	88	64	93	383	314	635	1,053	
Months coverage of accr'd warr. Res:	37.5	60.1	102.2	32.8	53.2	28.5	15.9	
30 kW units shipped:	11	22	171	126	211	210	235	
60 kW units shipped:	0	0	0	0	0	1	7	
Tot.Units shipped in qrtr	11	22	171	126	211	211	242	
Tot. units in commercial fleet (beginning of quarter)	9	20	42	213	339	550	761	1,003

Average age of commercial fleet at beginning of quarter (months)	1.9	3.0	3.7	2.5	4.0	4.9	6.1	7.3

In Dollars per unit:

In $	Q2 99	Q3 99	Q4 99	Q1 00	Q2 00	Q3 00	Q4 00	Q1 01
Warranty charge/unit (current quarter)	18,364	11,227	11,567	11,111	8,057	5,213	2,500*	
Actual cost of warranty per unit in fleet at start of quarter	9,778	3,200	2,214	1,798	<u>926</u>	<u>1,155</u>	<u>1,384</u>	
Sequential % change in cost to service warranty/unit			-31%	-19%	-48%	25%	20%	
Sequential % change in fleet age at beginning of Q			20%	-31%	60%	22%	25%	

* Based on company guidance in the Q4 conference call that charges for warranty reserve per unit in Q4 00, were "probably a factor of 4 or 5 lower than what it was at the beginning of the year."

It appears that one of the main problems the CPST unit has experienced has been a high failure rate of the unit's gas compressor, which is only lasting about 3,000 hours and costs about $1,500 to replace. While CPST is supposed to be introducing a compressor which should last far longer, it remains to be seen how successful the new component will be.

VI. Some recent gross margin improvement may be due to inadequate warranty reserves.

Capstone's underlying gross margin is improving more slowly than it appears. While at first glance it looks like CPST made significant 18 and 17 percentage point sequential improvements to gross margin in Q3 and Q4 respectively, in fact the majority of the improvement can be attributed to CPST lowering its warranty reserve charge per unit. If the warranty reserve charge component of cost of goods sold is subtracted out, CPST's gross margin improvements are dramatically lower, only 8 percentage points in each of the two quarters. Q4 00 gross margin would have managed only a 7% point improvement over Q1 00.

CPST's warranty charge per unit in Q4 may now be so low that little room remains for CPST to realize further nominal gross margin improvements in this fashion going forward.

$,000	Q1 99	Q2 99	Q3 99	Q4 99	Q1 00	Q2 00	Q3 00	Q4 00
Total Revenue	222	334	759	5,379	3,746	6,086	6,197	7,134
CoGS (as reported)	1,233	1,347	1,990	11,059	5,124	8,256	7,278	7,157
Warranty reserv in CoGS	173	202	247	1,978	1,400	1,700	1,100	605
CoGS (minus warranty reserve charge)	1,060	1,145	1,743	9,081	3,724	6,556	6,178	6,552
gross margin (reported)	-455%	-303%	-162%	-106%	-37%	-36%	-17%	0%
gross margin (minus warranty reserve charges)	-377%	-243%	-130%	-69%	1%	-8%	0%	8%

Even as CPST has been cutting the amount it expenses to accrued warranty reserve per unit, CPST's cost to service its warranty per unit is again rising. As a result, accrued warranty reserve actually declined in Q4.

Based on the accrued reserve of $5.6M at the end of Q4, and an actual warrant cost of $1.1M in Q4, the months of warranty covered by reserves fell sequentially by 44% to 16 months. This is the lowest coverage level in over two years.

In Q4 it was costing CPST about $1,384/unit per quarter to service warranties for all units in the field. However, according to company guidance in the Q4 conference call, it was charging only about $2,500 per new unit that it sold for warranty expense.

Capstone's warranty reserves, as a result, may not be sufficient to cover the actual costs it incurs. If this were the case, then some of the recent improvement in gross margins may be reversed, as Capstone may be forced to take higher reserve charges.

VII. Recent results indicate that Capstone will have difficulty meeting expectations.

CPST's business is already showing signs that it may not meet expectations. CPST barely met modest "street" revenue expectations for FY00. In Q4 CPST received orders (for shipment within 12 months) of only 158 units, which was down from 308 ordered in Q4 99, and down from about 301 in Q3 00. 158 units is also 35% below what CPST needed just to replace the 242 units it actually shipped in Q4. Backlog fell to 806 units in Q4 from 890 in Q3.

New orders have also declined sequentially for the past two quarters, down an estimated 26% and 48% in Q3 and Q4 respectively.

New orders announced from new distributorships, some of which are for delivery beyond 12 months, were also down sequentially 40% in Q4 to 452 units compared to 756 units in Q3.

	Q3 99	Q4 99	Q1 00	Q2 00	Q3 00	Q4 00
Tot. Units shipped in quarter	22	171	126	211	211	242
Backlog at quarter-end	173	310	601	800 (Est*)	890	806
Units ordered in Q		308	417	410 (Est*)	301 (Est*)	158
New units announced under distribution agreements					756	452

* Estimate: based on Q2 conference call guidance that backlog was 800 units at May 31

While some companies with a new product blame lack of manufacturing capacity for poor sales, this is not an issue for CPST as the company claims to have capacity to produce 20,000 units/yr, or 5000 units/Q. This means CPST was only producing at 5% capacity during Q4.

Japan is considered an important market for CPST's penetration of the "combined heat and power" market. However, deliveries to Japan seem to be progressing more slowly than expected. On page 39 of CPST's 11/6/00 prospectus, CPST writes of its Japanese distributors:

"All of these agreements require the Japanese partner to purchase on a prepaid basis 100 Capstone Model 330 (30 kW) MicroTurbine systems for delivery within 12 months from the signing of the agreement. We expect all 400 units to be delivered on or before December 31, 2000."

Based on CPST's quarterly ASPs and sales to Asia, by our calculations CPST had only delivered about 180 units to Asia in the first 9 months of 2000. Even including the 51 units CPST shipped to Asia in 1999, this would leave at least 169 units for delivery to Japan in Q4, which is too high since CPST has guided that only about a third of its unit shipments are to Japan, which would be just 81 units in Q4. Thus, shipments to Japan seem to be about a quarter behind expectations.

The "street" is projecting that CPST's new 60 kW unit will be a major driver for revenue growth in 2001. CPST had been projecting its 60 kW unit to be "available for commercial sale" in Q3, yet Capstone apparently shipped only one commercial 60 kW unit during the last month of Q3. In its 10/24/00 press release CPST claimed it would begin to ramp-up shipments in Q4 and in 2001. However, blaming a parts shortage, it shipped only 7 of the 60 kW units in Q4. Since only 1 60kW unit appears to have been shipped in Q3, Capstone significantly missed modest "street" projections for shipping only 21 60 kW units in FY00.

Part of the slowness may be due to the fact that as of the 11/6/00 prospectus, CPST only offered the 60 kW unit in a single configuration while its more established 30 kW unit is offered in 24 configurations. CPST is also "uncertain" whether their 60 kW unit will be able to operate on sour gas, which seems to be one of the few true advantages the units have over reciprocating engine generators running from natural gas.

VIII. Financial projections:

$,000	**Q4 00A**	**Q1 01E**	**Q2 01E**	**Q3 01E**	**Q4 01E**
Rev.	7,134	8,772	11,135	14,453	18,930
CoGS	7,157	8,270	10,281	13,062	16,712
Gross Profit	(23)	502	854	1,391	2,219
R&D	2,903	2,900	2,900	2,900	2,900
SG&A	6,803	6,973	7,147	7,326	7,509
tot. op costs	9,706	9,873	10,047	10,226	10,409
Inc. from ops	(9,729)	(9,371)	(9,193)	(8,835)	(8,190)
Int income	3,582	3,554	3,365	3,172	2,985
Interst expense	(182)	(180)	(180)	(180)	(180)
Other income	(28)	0	0	0	0
EBT	(6,357)	(5,997)	(6,009)	(5,844)	(5,385)
Inc. tax	0	0	0	0	0
Net income	(6,357)	(5,997)	(6,009)	(5,844)	(5,385)
Prf. stck	0	0	0	0	0
Net Inc.	(6,357)	(5,997)	(6,009)	(5,844)	(5,385)
Wt avg shrs	75,474	76,150	76,912	77,681	78,458
Net loss/ share	(0.08)	(0.08)	(0.08)	(0.08)	(0.07)
Capex	(6,749)	(7,000)	(7,000)	(7,000)	(3,000)
Cash	236,947	224,302	211,441	199,008	191,167
Rev.	100%	100%	100%	100%	100%
CoGS	100%	94%	92%	90%	88%
Gross Margin	0%	6%	8%	10%	12%
R&D	41%	33%	26%	20%	15%
SG&A	95%	79%	64%	51%	40%
tot. op costs	136%	113%	90%	71%	55%
Inc. from ops	-136%	-107%	-83%	-61%	-43%
Int income	50%	41%	30%	22%	16%
Interst expense	-3%	-2%	-2%	-1%	-1%
Other income	0%	0%	0%	0%	0%
EBT	-89%	-68%	-54%	-40%	-28%
Inc. tax	0%	0%	0%	0%	0%
Net income	-89%	-68%	-54%	-40%	-28%
Prf. stck	0%	0%	0%	0%	0%
Net Inc.	-89%	-68%	-54%	-40%	-28%

$,000	**F00A**	**F01 E**	**F02 E**	**F03 E**
Rev.	23,163	53,290	114,338	220,362
CoGS	27,815	48,325	94,846	177,124
Gross Profit	(4,652)	4,966	19,492	43,238
R&D	11,319	11,600	11,600	11,600
SG&A	24,067	28,956	31,962	35,280
tot. op costs	35,386	40,556	43,562	46,880
Inc. from ops	(40,038)	(35,590)	(24,070)	(3,642)
Intincome	9,589	13,075	10,971	10,262
Interst expense	(915)	(720)	(720)	(720)
Other income	(59)	0	0	0
EBT	(31,423)	(23,235)	(13,818)	5,900
Inc. tax	1	0	0	0
Net income	(31,424)	(23,235)	(13,818)	5,900
Prf. stck	(559,862)	0	0	0
Net Inc.	(591,286)	(23,235)	(13,818)	5,900
Wt avg shrs	46,107	77,302	80,441	83,707
Net loss/ share	(12.82)	(0.30)	(0.17)	0.07
Capex	(12,000)	(24,000)	(8,000)	(8,000)
Cash	236,947	191,167	172,208	175,496
Rev.	100%	100%	100%	100%
CoGS	120%	91%	83%	80%
Gross Margin	-20%	9%	17%	20%
R&D	49%	22%	10%	5%
SG&A	104%	54%	28%	16%
tot. op costs	153%	76%	38%	21%
Inc. from ops	-173%	-67%	-21%	-2%
Int income	41%	25%	10%	5%
Interst expense	-4%	-1%	-1%	0%
Other income	0%	0%	0%	0%
EBT	-136%	-44%	-12%	3%
Inc. tax	0%	0%	0%	0%
Net income	na	na	na	3%
Prf. stck	na	0%	0%	0%
Net Inc. to	na	na	na	3%