Wind when you want it. Storage technologies could plug us into more power from the air up there.

This is an article replete with lies, pie-in-the-sky, innuendos and suppositions. It is typical of the chicken-little articles of the seventies and is worth reading to see what nonsense is printed. It has been annotated to show the errors. It's based on words from a used-computer salesman and a Canadian CPA.

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Glen Estill's first appreciation of wind power was on a camping trip on the rugged hills of Newfoundland, during a short sabbatical after 20 years in the computer business.

The co-founder of computer wholesale company EMJ Data Systems remembers repeated attempts to set up a tarp at his campsite, only to have a gust of wind keep blowing it away.

"If you were looking for the lightbulb moment that would be it," says Estill. "It was windy all the time. It just seemed there was so much energy there."

[He might have had a similar flash of insight by watching fireflies over the marshes, but the episode is a piece of fiction that tries to portray Estill as a wind expert.}

He returned home to Ontario and began searching the Internet for information on the wind-power industry. Five years later, Estill is founder and president of Sky Generation Inc., a single-turbine wind power producer in Lion's Head on the Bruce Peninsula that will be expanding its operation to three turbines this summer.

Estill is among a growing legion of wind-power advocates who are concerned that Queen's Park is underestimating the potential of wind — and renewable energy alternatives in general — as a major source of clean electricity for Ontarians. They also worry the province is leaning too much on nuclear.

The Ontario Power Authority, in recommendations to the government released in December, believes nuclear should continue to represent about 35 per cent of generation capacity and 50 per cent of actual electricity production between now and 2025. It also suggests that $40 billion be earmarked for refurbishing old nuclear assets and building new ones.

Wind, on the other hand, is only expected to represent about 12 per cent of the 41,750 megawatts of generation the power authority says is required by 2025. That equates to about 5,000 megawatts of wind-power capacity, or roughly 3,300 wind turbines, and would supply only 8 per cent of electricity we actually consume.

It's not nearly enough, argue wind advocates, insisting that the province wouldn't have to invest as much in new nuclear — and untold billions of dollars on future radioactive waste disposal — if it pushed further with wind systems and other renewables, such as solar, biomass, and even geothermal.

They point to Denmark, where 20 per cent of electricity production already comes from wind farms, or Germany and California, where the hope is that renewables —

predominantly wind — will account for between 20 per cent and 30 per cent of the power generation mix by 2020.

"They're clearly not getting all the renewables we can," says Jack Gibbons, chair of the Ontario Clean Air Alliance, **[Despite it's apparent official title, this is a small group of green-enthusiasts living in never-never land.]** pointing to a report commissioned by the OPA that found 13,000 megawatts of wind power potential within 20 kilometres of the existing electricity transmission network. "We can assume that at least that amount is doable."

The Canadian Wind Energy Association believes it's reasonable for wind to reach the OPA's target before 2015 and account for 30 per cent of power capacity by 2025.

"Everybody in the industry knows it's very achievable," says Estill. "We don't need to limit ourselves to 5,000 megawatts, that's for sure**." [This from a used-computer salesman.]**

So why are we? Observers say it's partly because power planners and operators in Ontario are a historically conservative bunch, averse to straying too far from what they already know, such as nuclear.

It also turns out that smoothly integrating wind power into the electricity system isn't a breeze. Accommodating a healthy supply of wind energy requires some creative thinking — backed by political will — to overcome the resource's inherent limitations.

"The utilities are just not very proactive," says MacMurray Whale, an energy analyst with Sprott Securities Inc. in Toronto. "The long-term growth plan is really nuclear."

The fact is wind doesn't always blow where we need it. There may be plenty of wind blowing in northern Ontario, but building thousands of megawatts of wind projects there would require expensive upgrades to transmission infrastructure to carry that electricity south.

Perhaps wind's biggest limitation is that it doesn't blow all the time, or lacks "firmness" in industry lingo. When the wind does blow it's not always when we need it, on hot days in the middle of the summer when air conditioners are cranked high.

The intermittent nature of wind, a characteristic shared by other renewables such as solar, forces electricity system planners to heavily discount how much this otherwise ideal energy source contributes to the overall system.

During summer peak times — the two hours or so on certain days when electricity demand is highest — it's assumed for planning purposes that wind will only contribute 10 per cent of rated capacity. In other words, if a wind farm has a maximum output of 100 megawatts when all turbines are spinning under ideal conditions, the province will only count on 10 megawatts actually making its way to the grid.

That contribution will rise to 20 per cent during the winter, a windy time of the year.

"If you look at the energy produced over the whole year, then 30 per cent isn't a bad contribution from wind," says Don Tench, director of planning and assessment at the Independent Electricity System Operator, which manages the power balance in the province.

Tench says it's easier to manage the fact wind power is intermittent when other "flexible" energy resources are available, such as natural gas and coal plants that can be fired up to fill the power gap when the wind stops blowing.

But since wind power is generally used to replace those dirtier fossil-fuel plants on the grid, the system tends to become less flexible — and as a result less stable — as more wind capacity is added. Denmark, where significant power generation capacity comes from wind, is running into that problem now. "Common industry rule of thumb is that you don't expect problems at 10 per cent wind, but once you get a penetration above that you have to look more seriously at the flexibility of your other resources," says Tench.

Nuclear power plants, which provide "baseload" power to the province, have zero flexibility. They're difficult to stop and start and work best when running continuously at a constant output. Since nuclear accounts for 50 per cent of generation, Tench says the OPA's wind targets are "realistic" because Ontario has less wiggle room when it comes to balancing the overall mix, including wind.

It's a position wind advocates such as Estill and Gibbons reject. Both say nuclear power can be replaced over time by a combination of energy sources, technologies and approaches, including conservation.

Completely phasing out nuclear may seem extreme, but building more natural gas generation to complement and bring more "firmness" to wind power is one way of reducing the province's dependence on both coal and nuclear. "The flexibility (offered through natural gas) can be built over time," says Estill. `The utilities are just not very proactive. The long-term growth plan is really nuclear'

There will be costs, and gas plants expose Ontario taxpayers to rising natural gas prices, but Gibbons maintains it will be a bargain compared to nuclear, which has a history of cost overruns and will require that billions of dollars be spent to manage disposal of spent uranium.

"All new supply options are expensive," he says. "The point is nuclear is the most expensive." **[Actual cost figures show that this is a lie.]**

Estill agrees, adding that the cost of managing radioactive waste over 100,000 years **[note the implication that you have to manage waste over 100,000 years – that in itself is not true]** is never included in the economic analysis. "With a little bit of a creativity I have no doubt we can increase the amount of renewables and reduce the financial risks associated with having to go with nuclear."

There are other ways to unlock value from wind. A handful of cities in Iowa are working together to use electricity from a wind farm to force compressed air into rock formations deep underground**. [Not referenced and not true.]**

The air is then released when needed and mixed with natural gas for use in electricity-generating turbines. The group forecasts that the air will help lower natural gas consumption by 33 per cent to 50 per cent compared to a conventional gas turbine, making the system competitive with ordinary fossil-fuel plants.

One proven approach **[No, not proven – wind is not reliable enough to do this.]** is to couple wind farms with hydro dams. Wind power is used to pump water behind the dam, which acts like a massive natural battery.

The stored-up water then released to generate power when the wind isn't blowing.

Even easier is to stop or restrict water flow on a hydroelectric dam depending on how much wind power is being generated.

"To manage these two resources on a combined basis is powerful," says John Douglas, chief executive of Toronto-based wind developer Ventus Energy Inc., which has several large projects under development in Ontario, Quebec and Atlantic Canada.

But Douglas points out that the opportunities to combine wind and hydro-electric facilities in Ontario are limited compared to Quebec, where existing transmission infrastructure supports northern hydro projects.

Looking ahead, technologies are emerging that could make large-scale energy storage more economical for use with renewable resources such as wind.

"The role for energy storage in modern electricity grids of the future may be significant," according to a recent report prepared for the California Energy Commission, aware that its goal of having 33 per cent renewable electricity in the state's mix by 2020 will face some hurdles.

It estimates that by 2015 California wind projects would benefit tremendously from energy storage technologies, including utility-scale hydrogen fuel cell systems and next-generation "flow" batteries. Such technologies "would allow electricity to be produced at times of relatively low economic value and stored so that it can be dispatched at a later time."

Gas Natural SDG, a Spanish energy services company that operates a wind farm, recently purchased technology from Mississauga-based Hydrogenics Corp. that will let it convert excess electricity from wind turbines into hydrogen gas.

The clean hydrogen will be burned in an internal combustion engine — a fuel cell could also be used — to feed power to the grid during peak periods.

"We see this as a trend," says Pierre Rivard, chief executive of Hydrogenics. The company has received five similar orders in the past six months for renewable energy projects, including wind and solar. "This is a new and emerging area we never had before."

Most of the purchases are for demonstrating the potential of the technology, but he says as costs come down and as the price of natural gas and electricity rises there will come a point where hydrogen storage makes sense. [Betting on the come ... in fact this generation of hydrogen is far too expensive.]

"Hydrogen is too good an opportunity. We've got to do something to hedge our bets here."

Most inquires about electricity storage technologies are coming from Europe, says Vince Sorace, president of Vancouver-based VRB Power Systems Inc., which makes a massive **[The word 'massive' hides the fact that these are small batteries ... the massive is an adjective to 'flow.']**chemical "flow" battery that can store 10 megawatts of power for up to 12 hours.

"The biggest advantage of a flow battery is we can provide multi-megawatts," he says. "The energy is stored in a fluid, in an electrolyte, which is stored in tanks. If you want more hours you simply add more tanks and more fluid. Customers love that flexibility."

A VRB system is installed on King Island off southern Australia, where five wind turbines complement diesel generators to supply about 2 megawatts of power to the remote community. **[This example is equivalent to pointing to the viability of using a solar cell to power an emergency road sign. It is viable for a backwoods community with no other options but irrelevant to an industrial society. To replace the 1,500 MW from a typical nuclear plant the number of windmills would run into the hundreds and the unreliability would kill the idea.]** The massive-flow battery, the size of a small hockey arena, kicks in when the wind stops.

Sorace says the system is becoming economical in parts of the world where there's a big price differential — a gap of 10 cents or more — between peak and off-peak electricity.

That's not the case yet in Canada, but inquires are flowing into VRB from countries such as Ireland and Denmark where wind development is capping out.

Large-scale energy storage might not be an option for Canada's immature wind market, and may not be for years, but observers say a lot can happen between now and 2025.

It would be a mistake, they say, to rest so much of Ontario's energy future on nuclear technology.

"Twenty years is a long time," says Estill. "If there is another way, let's do it."