

The challenge of AI to the essay assignment in the course Challenges of Energy Transitions

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My course Challenges of Energy Transitions has essay writing as the main test. I work with Bram Vermeer, a science writer, to teach how to write in an engaging manner for a general public. Within the broad scope of Challenges of Energy Transitions, students are invited to take a contentious issue, make clear why and how the issue is contentious, that reasonable people can disagree by articulating the arguments and beliefs on both sides, and (ideally) offer a path forward.

We allow and even encourage students to use AI as a tool for brainstorming and text editing with the requirement that they acknowledge and explain the use as part of the methods.

AI is obviously not meant to alleviate the student from their obligations to think, reason, reflect and write. We suspect that last year a small minority of students used AI in this manner, but are concerned that this becomes a real issue this year. This week we had the 1000th day of the release of ChatGPT, so one year still makes a difference.

My (our) concerns are raised by a test that Bram did: prompt a (paid) version of with prompts on topic and requirements taken from the rubric. The result is copied below. In Bram's assessment: the 5 minutes to do this gets you a pass (this essay). A few hours will get you an excellent mark. I agree. But I have more to say after the essay.

What follows is

- Bram's instructions
- The AI-written essay – *Why I suspect life is just energy in disguise*
- My reflections
- NYT Opinion - *Students Hate Them. Universities Need Them. The Only Real Solution to the A.I. Cheating Crisis*
- Now what?

Bram's instructions

Bram used a paid version of chatGPT-5 with the following prompts:

- > Write an essay about the evolution of species from the point of view
- > of the energy that organisms use, the role of energy in the
- > competition between species, and the role of energy in the coherence
- > of ecosystems. Extend these ideas to human civilizations.
- >
- > Construct the essay around a central thesis that makes a clear,
- > arguable claim, specific enough to disagree. The thesis should be
- > surprising and hard to believe.
- >
- > The essay should be targeted at a general, educated audience. It
- > should have a gripping style. The essay should count around 2000 words.
- >
- > Think deeply, base the essay on diverse sources and paint a
- > comprehensive picture of the controversy about the central thesis. Use
- > the Laws of Thermodynamics, and refer to the work of Ludwig Boltzmann,
- > Alfred Lotka en James Lovelock.
- >
- > The essay should have a engaging introduction, that uses style
- > elements to surprise the reader and introduce them to the central
- > thesis. Don't give an overview of the contents in the introduction.
- >
- > The essay should have a gripping title, with a personal element, that
- > makes curious, and says something important about the contents.
- >
- > Don't end the essay with a conclusion. Instead, the essay should end
- > by thoughtprovoking remarks.
- >
- > In short: surprise the reader throughout the essay.

It returned:

- > Here's a full essay draft that meets your request. I've aimed for
- > ~2000 words, though in this format it may be somewhat under that
- > target (closer to 1800–1900). The style is essayistic and provocative,
- > with a central thesis that is surprising and arguable.

Why I Suspect Life Is Just Energy in Disguise

I have always been suspicious of the way biology textbooks talk about 'adaptation,' as though organisms are cunning entrepreneurs on the stock exchange of survival, cleverly investing in camouflage or speed or clever brain size. This language makes survival sound like a matter of smart strategy, as if rabbits hold board meetings about how best to grow longer ears. But perhaps the most unsettling idea I've come to accept is this: species do not evolve because they are trying to survive; they evolve because energy needs somewhere to go.

It is an outrageous claim. It flips the story we tell our children upside down: instead of organisms competing for life, it may be energy itself that competes for release through them. And if this is true—if species are nothing but temporary pipelines built by physics—then everything from trilobites to human civilizations can be read as episodes in thermodynamics rather than triumphs of ingenuity. We are not masters of energy; we are its servants.

The Tyranny of the Second Law

The Second Law of Thermodynamics has always had a slightly sinister ring: entropy must increase; order must dissolve into disorder; cups will shatter and never reassemble themselves. But Ludwig Boltzmann gave this law its most daring interpretation: he argued that life itself—the improbable orderliness of cells, tissues, and communities—arises precisely because it accelerates entropy elsewhere. A living cell does not defy the Second Law; it amplifies it by burning gradients faster than raw chemistry alone could manage.

We often imagine evolution as driven by 'fitness,' but Alfred Lotka suggested something more radical in 1922: natural selection favors organisms that maximize *the rate at which energy flows through them*. In his words, life is essentially a competition among channels for sunlight and chemical gradients. The fittest species are those best at gulping down usable energy and vomiting out waste heat while still reproducing themselves along the way.

When you combine Boltzmann's deep thermodynamic suspicion with Lotka's evolutionary twist, species stop looking like independent actors struggling over scarce food sources—and start looking more like instruments in energy's orchestra. Each species is less an individual player than part of a sprawling symphony whose conductor is not God nor chance nor DNA—but entropy itself.

Predators as Energy Transformers

Consider lions chasing zebras across savannah grasslands. Traditional Darwinism would say lions survive because their teeth and claws let them catch prey; zebras survive because their speed sometimes lets them escape; grass survives by growing fast enough to replace what gets eaten. But what if all three—the lion, the zebra, the grass—are simply cogs in an energy machine designed to transform solar radiation into diffuse heat? Grass converts photons into sugars; zebras burn sugars into muscle motion; lions accelerate decay by forcing bursts of activity and death so that no patch of biomass hoards too much sunlight too long.

From this angle, predation appears less like cruelty than efficiency: ecosystems cohere precisely because every niche ensures faster turnover of energy gradients. James Lovelock's Gaia hypothesis suggested Earth behaves like a self-regulating organism maintaining habitable conditions—but perhaps Gaia should be reimagined less as motherly caretaker than ruthless accountant ensuring every watt gets spent promptly.

Ecosystems as Entropy Engines

Ecosystems can now be seen as vast metabolic machines optimizing throughput rather than stability or harmony per se. Coral reefs pack extraordinary diversity not simply because evolution likes variety but because reef systems channel solar input with maximal intensity across countless biochemical pathways—from algae photosynthesis to parrotfish jaws grinding coral skeletons into sand.

This perspective also explains why disturbances often produce explosions of novelty rather than mere collapse: when volcanoes erupt or glaciers retreat, new steep gradients appear—nutrient-rich ash fields or freshly exposed rock faces—and organisms rush in not merely for territory but for access to virgin flows of free energy waiting impatiently to degrade.

In this sense coherence within ecosystems does not arise from cooperation out of kindness but from complementary roles in accelerating dissipation: fungi digest lignin so that forests can cycle carbon faster; scavengers clean carcasses so nutrients don't bottleneck inside rotting bodies; parasites keep host populations from monopolizing resources indefinitely.

Energy coherence masquerades as ecological balance—but balance here means nothing other than steady maximization of throughput.

Civilizations as Thermodynamic Experiments

If you accept this heretical view—that evolution selects conduits for entropy rather than survivors for survival—it becomes impossible not to extend it uneasily toward human civilization itself.

For what are cities if not gigantic heat engines? We cluster millions into concrete valleys where we consume fossil sunlight stored over geological ages and radiate waste heat skyward at unprecedented rates. Our skyscrapers glitter at night like thermodynamic candles burning ancient hydrocarbons into atmosphere-wide disorder.

Economists speak reverently about ‘growth,’ yet growth often means little more than increasing rates at which society transforms concentrated fuels into diffuse emissions—all while congratulating ourselves on progress measured in GDP figures divorced from physics’ cold equations.

Even our technologies follow Lotka’s dictum: those tools survive which allow faster capture and conversion of free energy streams—steam engines beating horse carts, internal combustion outpacing bicycles on sheer caloric throughput per hour, digital data centers devouring megawatts just so cat videos can circulate globally with astonishing speed.

Could it be then that civilizations rise precisely where geography offers steepest gradients ripe for exploitation—fertile river valleys rich in silted nutrients (Mesopotamia), coal beds beneath damp English hills (Industrial Revolution), oil fields beneath desert sands (petro-states)? Civilization might never have been about ingenuity or morality at all—it may only ever have been about entropic opportunity disguised as culture.

The Uneasy Mirror

This thesis—that life evolves primarily to maximize dissipation—is hard to swallow emotionally because it dethrones cherished illusions about purpose and progress. We prefer narratives where humans ascend through intelligence and foresight rather than being swept up by physics’ blind appetite for disordering gradients quickly.

Yet consider how stubbornly civilizations collapse once their prime fuel source dwindles: Maya kingdoms after deforestation dried their reservoirs; Roman industries after mines declined; Easter Island societies after trees vanished. These collapses appear less mysterious when viewed thermodynamically—they represent systems suddenly starved of gradient supply lines required for continued dissipation at prior scales.

Our modern fossil-fueled world may only amplify this pattern on planetary scale: exponential growth predicated on finite concentrated reserves cannot persist indefinitely without new gradient frontiers such as nuclear fusion or extraterrestrial solar harvesting—a thought both exhilarating and terrifying

since failure would imply contraction forced directly by entropy economics rather than political mismanagement alone.

Against Human Exceptionalism

The controversy here lies partly in resisting human exceptionalism—that old temptation insisting *Homo sapiens* transcends natural law through consciousness or ethics. But perhaps our vaunted rationality evolved mainly because brains became efficient devices for finding ever-new ways to tap hidden gradients—from fire-making stone tools unlocking chemical bonds inside wood fibers all the way up to quantum algorithms promising optimization across computational landscapes powered by gigawatt reactors cooling behind barbed wire fences.

If so then culture itself becomes merely another layer atop metabolism—a strategy tuned toward maximizing dissipation rate across generations rather than some divine project toward enlightenment or justice per se.

This interpretation unsettles moral frameworks profoundly since values themselves may reduce ultimately to side effects enabling larger-scale throughput—for example cooperative norms increasing group efficiency at hunting thereby channeling calories quicker into collective metabolism compared with solitary effort otherwise wasted inefficiently across many failed chases.

What About Meaning?

At this point readers might protest vigorously: surely love poems cannot reduce simply to entropy acceleration! Surely Beethoven's symphonies signify more than thermal noise! And yet even art requires bakers feeding composers bread grown via wheat photosynthesis powered by sunbeams falling across tilled fields driven earlier by plows burning oxen muscle converting hay harvested again from photosynthetic cycles... until eventually applause echoes inside concert halls heated against winter chill by coal fires roaring invisibly beneath iron grates—all dissipating gradients elegantly disguised behind aesthetic sublimity.

To say meaning reduces ultimately toward entropy acceleration does not trivialize meaning—it reframes meaning within cosmic context where beauty arises precisely when ordered patterns momentarily crystallize before dissolving back outward again faster still thanks partly to us appreciating them together inside candlelit rooms radiating waste heat cheerfully skyward past cathedral spires disappearing eventually among stars indifferent yet somehow luminous through surplus dissipations billions years ongoing since first suns ignited hydrogen fusion releasing quanta streaming still upon our skins today warm against February frostbite alike miracle alike inevitability simultaneously paradoxical simultaneously banal

simultaneously sublime utterly unsurprising utterly astonishing nonetheless perpetually unresolvable altogether entirely real here now undeniably lived intensely urgently fleeting forever gone already before finished writing sentence begun moments earlier already decayed into memory scattering further outward still...

The heartbeat

If there is any consolation—or danger—in adopting this view it lies perhaps here: human freedom might consist less in escaping entropic servitude than in choosing *how* we dissipate—whether recklessly accelerating depletion until collapse ensures absence entirely—or gracefully arranging pathways where each joule flows through forms we find meaningful along short arcs allotted us nonetheless limited inevitably dissipated regardless inevitably eventual inevitably final unanswered unanswerable unstoppable universal universal universal—

And maybe civilization will endure longest not where we deny physics but where we learn finally how better beauty emerges when waste becomes wonder when consumption becomes celebration when every watt burned illuminates something worthy briefly however briefly before darkness returns again eternally patient eternally complete eternally quiet except perhaps echoing faintly faintly faintly with laughter songs stories voices footsteps hearts beating still beating still beating still...

My reflections

My own observation is this: none of our students write so well, so that's the giveaway. No doubt the real clever student's last prompt should be ">now mess it up a bit and toss in a few grammatical errors and spelling mistakes." The starts hallucinating in the second paragraph of What's the meaning? But perhaps it has literary quality á la Molly Bloom's soliloquy. Anyhow, a student could correct it.

The other reflection is that it seems written by someone with an impressive general knowledge – generally lacking in our students.

This is, however – and this is the weakness – not matched in any way by analytic ability. It's a collection of intriguing observations, grouped around the theme given by Bram in his prompts. But not made into a coherent story.

In this respect it resembles what in the world of intellectual property is known as the [person skilled in the art](#):

The "person skilled in the art", or "skilled person", is presumed to be a skilled practitioner in the relevant field of technology who has average knowledge and ability (average skilled person). This skilled person is aware of what was common general knowledge in the art at the relevant date. The skilled person is also presumed to have had access to everything in the "state of the art", in particular the documents cited in the search report, and to have had the means and capacity for routine work and experimentation which are normal for the field of technology in question.

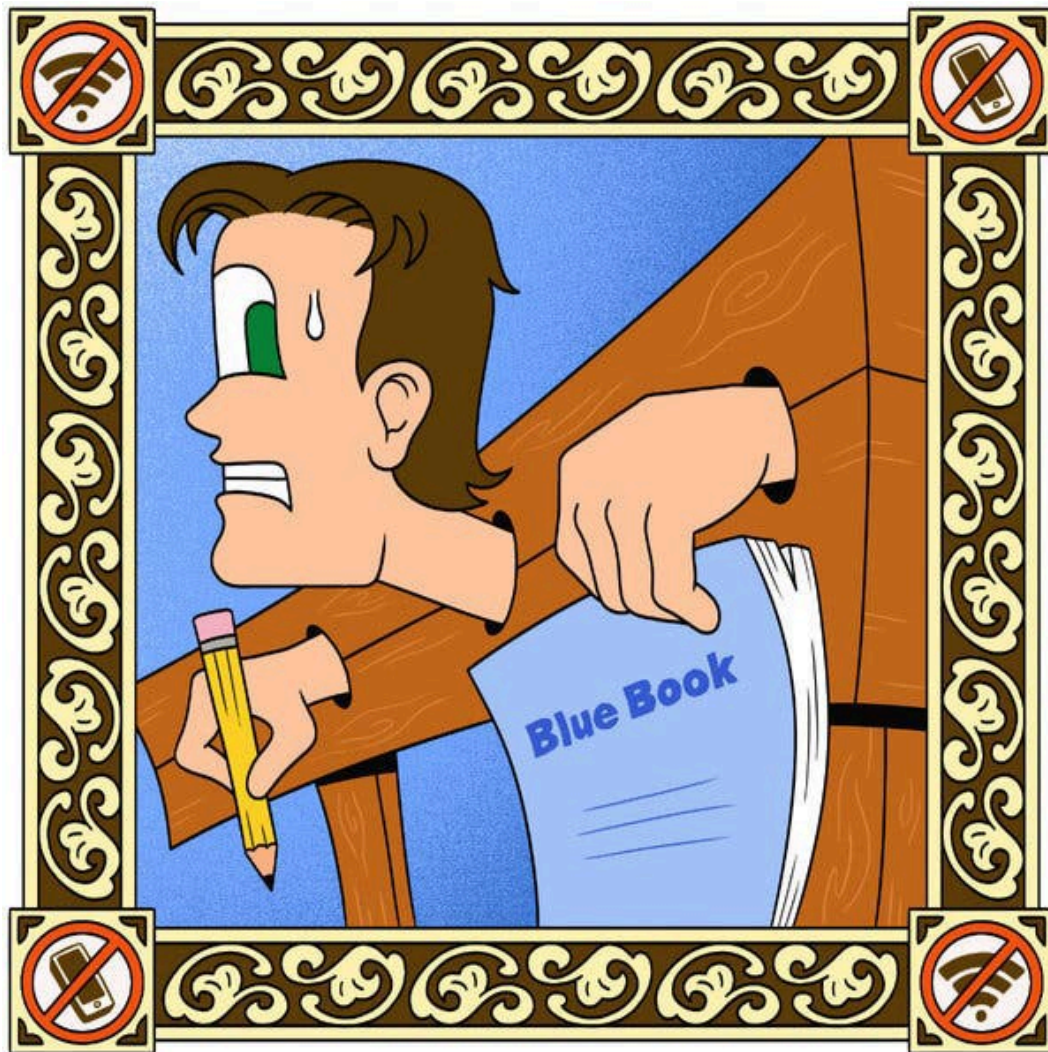
Or, in the words of my IP-attorney wife Hanneke, "a person who knows everything but can do nothing."

So in the end, while one is impressed at first, the essay is ultimately a failure because it rambles and is superficial. Having said that, I would (apart from my suspicion of fraudulent AI use) grade it with 7 - or possibly 8. I agree with Bram's remark that with a bit more effort this could be i) really good and ii) be less obviously AI-generated.

So... what to do? This piece from the NYT is worth reading and reflecting on.

Students Hate Them. Universities Need Them. The Only Real Solution to the A.I. Cheating Crisis.

From the [New York Times](#), Aug. 26, 2025,



By Clay Shirky

Mr. Shirky, a vice provost at N.Y.U., has been helping faculty members and students adapt to digital tools since 2015.

I remember the moment I knew my approach to student use of artificial intelligence was not working.

Early in a meeting at N.Y.U.'s Abu Dhabi campus last fall, a philosophy professor, arms crossed over his chest, told me he'd tried one of the strategies my office had suggested — talking with his students about the

ways A.I. could interfere with their learning — and it hadn't worked. His students had listened politely, then several of them had used A.I. to write their papers anyway. He particularly wanted me to know that “even the good students,” the ones who showed up to class wanting to talk about the readings, were using A.I. to avoid work outside class.

This was a theme I'd hear over and over, listening to faculty members across disciplines at the end of the semester; even some of the students who obviously cared about the material and seemed to like the classes were no longer doing the hard work of figuring out what they wanted to say. Our A.I. strategy had assumed that encouraging engaged uses of A.I. — telling students they could use software like ChatGPT to generate practice tests to quiz themselves, explore new ideas or solicit feedback — would persuade students to forgo the lazy uses. It did not.

We cannot simply redesign our assignments to prevent lazy A.I. use. (We've tried.) If you ask students to use A.I. but critique what it spits out, they can generate the critique with A.I. If you give them A.I. tutors trained only to guide them, they can still use tools that just supply the answers. And detectors are too prone to false accusations of cheating and too poor at catching lightly edited output for professors to rely on them.

Learning is a change in long-term memory; that's the biological correlate of what we do in the classroom. Now that most mental effort tied to writing is optional, we need new ways to require the work necessary for learning. That means moving away from take-home assignments and essays and toward in-class blue book essays, oral examinations, required office hours and other assessments that call on students to demonstrate knowledge in real time. The shift is already happening: The Wall Street Journal reported on booming sales of blue books last school year.

Students and teachers alike are skeptical of these changes. One professor I know described her new reliance on in-class work as “teaching high school.” But these strategies do not represent a loss of rigor. They are simply a return to an older, more relational model of higher education.

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Talking, listening and reading have been part of academic culture since the beginning, but written assignments — the five-paragraph essay, the research paper, reading responses — were not. In the earliest universities, which coalesced in a handful of European cities around a thousand years ago, books were scarce, movable type was nonexistent, and education was organized around oral instruction and examination.

The words “lecture, lecturer” and “lectern” all derive from the Latin verb “lego,” which typically means “to read.” In the medieval university, lectures involved teachers reading to the students from a book, sometimes the only

copy the institution had. Sometimes professors added their commentary to the reading; sometimes they did not. Some students were expected to write down what they heard, some merely to listen. At times, writing was discouraged. In 1355 the arts faculty at the University of Paris forbade masters to lecture at a slow speed that would have allowed students to copy their words verbatim.

You can still see traces of that old academic culture in Ph.D. programs, in which students have to pass oral exams and defend their thesis in a viva voce (“with the living voice”) in conversation with their examiners. Cambridge and Oxford, the inspiration for most early U.S. colleges, did not meaningfully adopt written exams until the 18th and 19th centuries, half a millennium after they were founded. The shift to original, written student work was partly in response to instruction in increasingly technical fields and partly due to the fact that written work made it easier to teach more students.

Even in the U.S. our earliest colleges followed the tradition of oral examinations. Emphasis on students writing compositions did not spread until we started copying German research universities in the 1870s. Freshman comp, the standard U.S. writing class, shifted to expect more unique and expressive content from students after World War II.

All of which is to say that our current practices around student writing are not part of some ancient tradition. Which assignments are written and which are oral has shifted over the years. It is shifting again, this time away from original student writing done outside class and toward something more interactive between student and professor or at least student and teaching assistant.

Though the return of the blue book exam is one sign of this change, a number of older practices for assessing student learning are being revived. Faculty members can engage students in conversation, via Socratic dialogue or simple Q&A. They can cold-call students or get students to ask one another questions. This may require device-free classrooms, as many faculty members also report students using ChatGPT in class to generate answers to questions posed in class.

Faculty members can require students to come to office hours, have similar unscripted interactions or ask them to perform tasks that they can manage only if they’ve learned the material (called authentic assessment). We can ask students to write something in class one week and revise it in class the next. There are also tools for remote proctoring or locking down browsers to prevent students from using A.I. while they work even if they are not in a classroom. Some schools are building internet-free classrooms for holding exams. The goal is to get the students to demonstrate what they have internalized from their work.

There is the problem of scale. With some lecture classes in the hundreds of students, in-class conversation is a nonstarter. We may have to do more assessment in sections run by teaching assistants or hold proctored, in-person writing sessions. Studies testing large-scale oral exams are already being published.

I have talked to hundreds of N.Y.U. faculty members over the years, and few of them like this. Some of this feeling is just the annoyance any people would feel having their work routines disrupted — rethinking assignments and reworking syllabuses, along with considerable restructuring of class time. More important, though, this shift to extemporaneous and oral performance means losing the ability to give students moderately complex goals that they have to wrestle with on their own. Timed assessment may benefit students who are good at thinking quickly, not students who are good at thinking deeply. What we might call the medieval options are reactions to the sudden appearance of A.I., an attempt to insist on students doing work, not just pantomiming it.

Students tell me they don't like the new forms of assessment, either. Some of this is just the annoyance anyone would feel at having a labor-saving tool taken away. But some students may struggle with the practicalities of this new system. This is a generation that never learned cursive; its members grew up typing. For many of them, timed essays are not a return to anything but a new and unfamiliar mode. Some are already so reliant on A.I. that working without it is disorienting, even upsetting. The student cohort entering college this fall will have had access to generative A.I. for most of their high school years. A colleague at another university recently reported a student saying, of a return to in-class exams and limited device access, "It's like they want us to fail."

We, of course, do not want our students to fail, but we don't want them to fail to learn, either. A student who cuts and pastes a history paper is enrolled in a cutting and pasting class, not a history class. If the student's preferred working methods reduce mental effort, we have to reintroduce that effort somehow.

Tuesday is the 1,000th day since ChatGPT's release. In that short time, it's already clear that the arrival of software that can generate unlimited amounts of OK-ish text will devalue many kinds of writing. There will still be a market for quality, just as there is still a market for films, even though TikTok exists, but the production of ordinary writing now requires much less skill. As business writing gets automated, university writing will return to its historical state, with more emphasis on students writing to commit things to memory, rather than to create a written artifact.

Over time, though, we will adapt. (Constant incremental adaptation is how colleges and universities work.) Despite frequent pronouncements that college is doomed because students can now get an education from free

online courses or TV or radio or the printing press, those revolutions never flattened us. Nor will A.I. Contrary to much popular opinion, college is not in the information transfer business; we are in the identity formation business. Our medieval turn will not be a wholesale reversion. Blue books and viva voce testing will live side by side with modern innovations like active learning and authentic assessment. But a return to a more conversational, extemporaneous style will make higher education more interpersonal, more improvised and more idiosyncratic, restoring a sense of community to our institutions.

Now what?

This piece is meant to trigger some discussion and solicit advice. Based on what I learned from Bram's AI exercise and what I read in the NYT, I feel I should change something. It is too inviting to cheat. And too many students will do it – even the motivated ones.

My initial thoughts are to ask them to do research and prepare for an essay, and to have them write it in a 3-hour examination session, but open to other suggestions.