



# Busting dogmas, building brains: creating opportunity and solving challenges through technology, teamwork and know-how

Speaker: **Cindy Yeilding**  
Title: **vice president - GOM exploration**  
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Good morning and thank you very much, Marcela. I am pleased and honored to be invited to speak at this important conference.

In a talk like this, it is customary to regale audiences with stories of personal and professional barriers encountered and overcome. I'm not going to do that today - much.

What I really want to talk about is overcoming biases and challenges within our industry, and the prize that awaits those of us who do it really, really well.

Let's start by discussing dogma, and the opportunities created through challenging it.

Dogma is defined as a prescribed doctrine proclaimed as unquestionably true.

Dogma is not the same as truth. It describes simply an accustomed way of thinking, or "conventional wisdom." John F. Kennedy once likened dogmatic thinking as "the comfort of opinion without the discomfort of thought."

How do we distinguish dogma from truth? I like to use what I call the "Toddler Method."

Your colleague says "That will never work!"

You ask, "Why"?

"Because it's never worked!"

Again, "Why?"

They retort, "There's no evidence it will work!"

You ask: "why couldn't it work"

If you haven't gotten solid proof after seven or eight rounds of this "WHY", you likely have a "dogma" on your hands.

Though it is often associated with religion, we find dogmatic thinking throughout our everyday lives. Here's a hopefully dated example: Women can't be scientists.

My path started back in high school, when I was the cheerleader who was good at math.

So when I got to college, I thought I wanted to be a math major. But after a few college-level math courses, I discovered that while I liked math, I didn't like it that much;



What was interesting? Geology. Work outdoors in gorgeous settings, learning about the Earth, working as a team to solve problems. What a blast!

After picking up a master's degree, I went to work for BP. I've been there ever since, and have never wanted to go anywhere else.

Why? Because our industry supplies light, heat and energy for people to get to work, school, and operate their businesses. We offer exciting and rewarding careers. And while we work on a future renewable energy, the oil and gas we produce keeps the world running, and will be a significant part of the global energy mix for decades to come.

I spent much of my early career working offshore, where I discovered another dogma: women are bad luck offshore.

That might be partially correct, because in my first few years offshore, we found very little oil or gas.

I eventually figured out that what bothered the all-male rig crew the most was that I was a geologist. Here's what a crew full of engineers think of a geologist: We want to stop and look at samples. We think we understand drilling but we don't. In short, we just plain get in the way. Being a woman came way behind being a geologist.

But I built relationships and shared my understanding of each well's objectives and geology. They began understanding the value and insights I brought to the well. So when men on the rig started throwing around terms like "stacked channel complex" and "Miocene nannofossils," I knew I had become a part of the team. That I was the only woman for hundreds of miles didn't matter.

Throughout my career, I've been fortunate to have my share of successes, mixed in with a few resounding failures. But one of the biggest lessons I've taken away is that in our industry, it isn't race or gender that defines us: it is our brains. And while there are some massively brilliant brains around, we get the most value via the Bigger Brain: applying and including everyone's experience, insights and know-how to create solutions to complex problems.

And when you use that bigger brain to start busting accepted dogmas, amazing things can happen.

So today, I want to speak with you about three things:

- First, the challenge our industry faces in meeting the global demand for energy
- Next, the opportunities created by coming up with new concepts and ideas and the technology we are developing to deliver these resources; indeed, we are a High-Tech industry!
- And finally, how we are developing "the Bigger Brain," or the human factors and behaviors required to meet this challenge.

## 1. First, the energy challenge

The world consumes roughly 3.6 million barrels of oil per hour, or 88 million barrels per day. In other words, in the half hour that I am up here, the world will have used 1.8 million barrels of oil.

And oil is not a renewable resource. Once we use it, we lose it. We need to find more.

And we can't just replace what we've used up. If we want energy security, job growth and the economy to prosper, we need to find more than we had before.

Over the decades, as consumption of oil and natural gas has increased, there have been repeated predictions that the United States and the world are running out.



Dogma alert: “Within the next two to five years, the oil fields of this country will reach their maximum production, and from that time on we will face an ever-increasing decline.”

That projection was issued by Van S. Manning, director of the US Bureau of Mines -- in 1919.

In his famous cardigan sweater energy speech in 1977, former President Jimmy Carter warned that world oil supplies could be exhausted by the end of the next decade. In other words, by the end of the 1980s.

None of that happened, of course. People learned to use energy more efficiently, and our industry has found new supplies to meet the demand.

However, the challenge remains. And looking ahead to the next 30 years or so – we expect that that challenge will be even more daunting.

Two years ago, BP has begun publishing an annual report called Energy Outlook 2030. It projects global energy demand growing by 40 percent – the same as adding another United States and another China.

The fastest growing fuels during that time will be renewables, including wind and biofuels, which are expected to grow at 8.2 percent per year.

Here we face a fairly new dogma: the notion that we can “jump” to renewables as soon as the technology is available. While this is a goal we can all align with, Energy Outlook 2030 brings us back to reality. Even with increasing use of alternatives, 87 percent of US transportation fuel will still be oil-based two decades from now.

That means we need more oil. A lot more. How will we get it?

We can increase production from existing fields, but that only takes us so far. We will also have to explore. So let’s discuss how new technologies and know-how are increasing production in the US.

## 2. Dogma-busting and the role of technology

I love working in exploration because all projects begin with some new concept or technology.

So almost by definition, exploration involves dogma-busting. Unique ideas, and the technical and business case to justify pursuing them, are what create opportunity.

And in the process, ours has become a very high-tech industry. For people raised on images of James Dean and his rig in *Giant* or John Wayne in *Hellfighters*, that can be hard to believe, but it is true. Today’s energy industry compares to those days the way a rotary dial telephone compares to an iPhone.

But no matter how sophisticated our technology becomes, nothing changes the fact that working with hydrocarbons that are under high pressure and at high temperatures involves certain risks. Those risks cannot be eliminated, but they can be managed.

After the Gulf of Mexico accident in 2010, BP strengthened our Safety & Operational Risk function to enhance processes and capabilities in safety and risk management. The specialists in that function work alongside our businesses to advise, inspect and, if necessary, intervene.

We have hired experts from high hazard industries such as nuclear power, space exploration, chemicals and the military, and with their help we are developing more rigorous standards that meet or exceed industry norms.



These and other fundamental changes were put in place to assure a deep, standardized, and verifiable approach to reducing risk across our global operations.

Now I'd like to talk about some of those operations. Important as safety is, we are first and foremost an industry that explores for and produces energy for the world. And we are using technology and bigger brains to bust some serious dogmatic ideas.

I mentioned one of these dogmas near the beginning of my talk: the predictions by serious people that we are running out of oil and gas. The reason they have been wrong is they tend to underestimate the potential for technology to open up new resources and maximize what we have got.

Let consider some examples from the body of water just 40 miles from where we are sitting now: the Gulf of Mexico.

Twenty years ago, it was dogma that the Gulf was finished as a major hydrocarbon basin. With the exception of BP and Shell, most of the major companies left.

Some beliefs of the day: while there was a working hydrocarbon and reservoir system, the trap and charge did not work well. Also, the technology challenges to drill and produce in deepwater left some believing that even if we found oil, it would be cost-prohibitive to produce it.

BP's big breakthrough came in the mid-90s when we stopped exploring for geophysical amplitudes or "bright spots". We asked ourselves how we would tackle any other basin in the world and came up with the breath-taking concept of exploring through the first principles of geology. This resulted in exploring for structural, not stratigraphic traps and exploring in deeper water for deeper reservoirs. We faced many challenges: the most perplexing being...

Salt!

Most of the Gulf of Mexico seabed is covered by a massive and complex canopy of salt, which tends to distort normal seismic imaging. The difference has been compared to discerning what is happening behind a pane of frosted glass as opposed to clear glass.

So if we were to succeed in the Gulf, we had to find a way of seeing through that salt canopy. We needed a geophysical breakthrough.

And we solved it in about five hours.

That's a bit of an exaggeration, but not that much of one. And it illustrates the value of a bigger brain.

My team and I were discussing the need for higher density seismic data in the GoM to image around salt, and we arrived at the conclusion that solving it was just too hard. But later, after the meeting was over, John Etgen, one of our research scientists, came back to see me with a bit of dogma-busting.

He said he thought the problem was solvable – the technology to acquire and process this data was within reach. It was the logistics -- simultaneous operations by a flotilla of boats to acquire the data -- that made it prohibitive.

I asked John, "Well, it might be hard, but is it do-able?" John thought it could be done. So we moved forward.

The result was WATS -- wide-azimuth towed streamer seismic. And the really interesting thing about WATS is that it is not really new technology. It is a new way of using existing technology. By combining and processing the data from multiple sound source boats, a much clearer picture of the geology below the salt emerges.



John Etgen, along with Carl Regone and Michelle Judson, did the heavy lifting of proving the value of WATS for BP. For their work, the team received the prestigious Virgil Kauffman Medal from the Society of Exploration Geophysicists.

WATS is a big reason the Gulf of Mexico now provides about 22 percent of US domestic crude oil production, according to the Energy Department. And WATS will help ensure that the Gulf will remain a major source of hydrocarbons for many years to come.

The approach of exploring against our geologic principles has worked and resulted in net discovered resources of well over 3.5 bn boe since we began

Successful exploration of deeper rocks has led to even greater challenges in the Gulf. There are multiple technology challenges associated with these reservoirs, including higher pressures and temperatures.

Earlier this year, BP announced "Project 20kTM." This is all about developing the technology to be able to produce deepwater fields with reservoir pressures and temperatures, beyond what we are now capable of doing. Over the next decade, we will work with others to develop an integrated system, from the rig and riser, the subsea kit, to the well and the ability to intervene.

We are hoping that Project 20k will bust the dogmas that say operations at such depths are technologically impossible. We know that making this vision a reality will require unprecedented collaboration across and outside our industry, involving operators, engineers, vendors, contractors, academics and regulators.

But we wouldn't be doing it if we didn't believe it was possible. We just need to build an even bigger brain!

### 3. The human factor: the biggest brain

All that technology is for naught if we don't know how to apply it. Our challenges are complex and multi-disciplinary. It can take thousands of people to move a project from access to discovery into production.

What is the bigger brain? It is "know-how," experience to solve problems and the ability to innovate. It's about pulling ideas and concepts from everyone and collaborating to find the best business and technical solutions. The biggest brain crosses disciplines -- gender, race, identity orientation -- integrating and including everyone in the process.

Ultimately, of course, to build a bigger brain, you need the brains to begin with.

We've been doing a lot of thinking lately about where we are going to find them.

That's because right now, the energy workforce is made up mostly of people who were hired in the late 1970s and 1980s. That work force is today highly experienced. It is also aging, and rapidly.

Of the roughly 6,300 leadership-level BP employees in the US, nearly half of them are age 51 or older. Add in those who are 41 or older, and the number climbs to more than two-thirds.

And while I don't have figures for other major energy companies, they probably look very similar.

Within the industry, what we are experiencing is known as "the Great Crew Change."

Experience is valuable, but so is intelligence, team-work and enthusiasm.

Think back to your early career. Were you happiest when you were challenged and contributing? Here's a story from my youth:



I was assigned to relinquish a sub-economic discovery to the government. To learn and understand what we were giving up, we asked for the time to further evaluate the project. The subsurface team worked together, reduced the geologic uncertainty and confirmed that we had an economic, if just barely, field.

The real dogma-busting came when our facilities engineer challenged the assumptions made about using a Tension Leg Platform and demonstrated that a Fixed Platform would work. This break-through strengthened the economics significantly and enabled the BP to move the discovery into production, where the revenue from the field help “keep the lights on” for our Houston office for several years.

The team was composed of a reservoir engineer, a facilities engineer and a geologist, each with just 4 years of experience. We were guided by a senior geophysicist with a whopping 15 years of experience and plenty of strong mentors.

So, let's welcome these new entrants into our industry, support and challenge them and help them make the types of contributions we were able to make early in our careers.

Other changes are also becoming visible. The leadership team where I sit today looks quite different from only five years ago. Then, it consisted wholly of men -- very talented and nice men -- but all men.

The same team today is very different: visibly different in gender and culture. More than half of the people on the team are women and people of color.

And that's not the end. That is the beginning.

BP CEO Bob Dudley sees diversity and inclusion as one of our top priorities.

He believes this is essential in order to attract, retain, and motivate the best talent available globally — as well as reflect the societies in which BP works.

So we need to hear from everybody. To do this, we need to embed diversity and inclusion as part of our Industry's DNA. That's how you build the biggest brain.

## Conclusion

What do I hope you'll take away from this talk?

We know that the world needs our industry and will continue to rely on us for heat, light, mobility, job and energy security for decades to come. Meeting that demand requires challenging preconceived “dogma” surrounding exploration and production.

Next, that we are a high-tech industry. Houston is no longer just America's outer space capital, but its inner space hub as well. We need the same kind of brainpower and determination to reach our energy goals as NASA did to take us to the moon.

In our industry, teamwork and collaboration are key. Everyone's ideas and knowledge are needed to seize the opportunities and meet the challenges. Find a way to listen to the quietest voice in the room. Welcome new entrants into our industry and support them as they learn, grow, and yes, challenge some of the industry dogmas.

A man who knew that well was Wallace Pratt, one of the first geologists employed by an energy company. He pioneered the idea that the key to finding oil and gas was not luck or instinct, but systematic, technical knowledge.

Over his long life, Pratt wrote several books, and hundreds of articles explaining his views. But he summed up his life's work in a single sentence.



"Gold is where you find it," Pratt said. "But judging from the record of our experience, energy must be sought first of all in our minds."

I'm sure that includes many of the great minds present in this room today.

Thank you all for listening and I look forward to opening it up for conversation.