Range’s Path to Discovery and Commercialization of the Marcellus Shale—The Largest Producing Gas Field in the United States*

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Key Points

Role Played by Range Resources

- Pioneered and discovered the Marcellus Shale in 2004, America’s largest producing gas field.
- Pioneered and played key roles in several other exciting plays across the country.

Range Resources in 2003

- Company with market capitalization of approximately $400 million
- Strategy was growth through development drilling, traditional exploration (high risk, theoretically high return) and complementary acquisitions; also not repeatable

A New Strategy

- Look for opportunities that, if successful, could become large scale and repeatable.
- Resource plays, including Marcellus shale
- Challenge became test of Marcellus Shale with Barnett style water frac on Renz #1.

Key Lesson #1: Creativity with Strong Scientific Basis Tops Conventional Wisdom

- Renz #1 – The Discovery Well, could we make it work horizontally?
- Decision: The target was large enough; risk was worth taking; Range moved forward, took the “unconventional path.”

Key Lesson #2: Focus

- Opened a Pittsburgh office, whose sole purpose was to make the Marcellus work.
• Application of Three Point Correlation with successful completion of Range’s first 8 horizontal wells; projection of Marcellus’ immense potential.

Key Lesson #3: Do the Right Thing
• Exercised “best engineering practices.”
• Pennsylvania has modernized regulations, some of the best in the country. The Marcellus Shale is now the largest producing gas field in the United States.

Significance of this Discovery and the Shale Revolution in General—Includes:
• U.S. gas reserves have increased dramatically; natural gas prices are competitive.
• Potential rebirth of American manufacturing and feedstock for petrochemical industry.
• U.S. is supplying about 84% of its energy needs; oil imports drops to roughly 40%
• Dramatic environmental, health, and financial benefits with use of natural gas in generation of electricity.

Looking Back
• Analogy was to the Barnett; Marcellus is now superior.
• Marcellus transforming how gas moves in the U.S., it is significant source of NGLs.
• Other potential targets are present in the play.
• As of May, 2013, market capitalization is about $12 billion. Assuming 80-acre spacing per well, only 6% of Range’s Marcellus acreage has been drilled.
Range’s path to discovery and commercialization of the Marcellus Shale – the largest producing gas field in the United States

May 2013

Jeffrey Ventura, Chief Executive Officer
Forward Looking Statements

Statements concerning well drilling and completion costs assume a development mode of operation; additionally, estimates of future capital expenditures, production volumes, reserve volumes, reserve values, resource potential, resource potential including future ethane extraction, number of development and exploration projects, finding costs, operating costs, overhead costs, cash flow, NPV10, EUR and earnings are forward-looking statements. Our forward looking statements, including those listed in the previous sentence are based on our assumptions concerning a number of unknown future factors including commodity prices, recompletion and drilling results, lease operating expenses, administrative expenses, interest expense, financing costs, and other costs and estimates we believe are reasonable based on information currently available to us; however, our assumptions and the Company’s future performance are both subject to a wide range of risks including, the volatility of oil and gas prices, the results of our hedging transactions, the costs and results of drilling and operations, the timing of production, mechanical and other inherent risks associated with oil and gas production, weather, the availability of drilling equipment, changes in interest rates, litigation, uncertainties about reserve estimates, environmental risks and regulatory changes, and there is no assurance that our projected results, goals and financial projections can or will be met. This presentation includes certain non-GAAP financial measures. Reconciliation and calculation schedules for the non-GAAP financial measures can be found on our website at www.rangeresources.com.

The SEC permits oil and gas companies, in filings made with the SEC, to disclose proved reserves, which are estimates that geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions as well as the option to disclose probable and possible reserves. Range has elected not to disclose the Company's probable and possible reserves in its filings with the SEC. Range uses certain broader terms such as "resource potential," or "unproved resource potential," "upside" and “EURs per well” or other descriptions of volumes of resources potentially recoverable through additional drilling or recovery techniques that may include probable and possible reserves as defined by the SEC’s guidelines. Range has not attempted to distinguish probable and possible reserves from these broader classifications. The SEC’s rules prohibit us from including in filings with the SEC these broader classifications of reserves. These estimates are by their nature more speculative than estimates of proved, probable and possible reserves and accordingly are subject to substantially greater risk of being actually realized. Unproved resource potential refers to Range's internal estimates of hydrocarbon quantities that may be potentially discovered through exploratory drilling or recovered with additional drilling or recovery techniques and have not been reviewed by independent engineers. Unproved resource potential does not constitute reserves within the meaning of the Society of Petroleum Engineer's Petroleum Resource Management System and does not include proved reserves. Area wide unproven, unrisked resource potential has not been fully risked by Range's management. “EUR,” or estimated ultimate recovery, refers to our management’s internal estimates of per well hydrocarbon quantities that may be potentially recovered from a hypothetical future well completed as a producer in the area. These quantities do not necessarily constitute or represent reserves within the meaning of the Society of Petroleum Engineer’s Petroleum Resource Management System or the SEC’s oil and natural gas disclosure rules. Our management estimated these EURs based on our previous operating experience in the given area and publicly available information relating to the operations of producers who are conducting operating in these areas. Actual quantities that may be ultimately recovered from Range's interests will differ substantially. Factors affecting ultimate recovery include the scope of Range's drilling program, which will be directly affected by the availability of capital, drilling and production costs, commodity prices, availability of drilling services and equipment, drilling results, lease expirations, transportation constraints, regulatory approvals, field spacing rules, recoveries of gas in place, length of horizontal laterals, actual drilling results, including geological and mechanical factors affecting recovery rates and other factors. Estimates of resource potential may change significantly as development of our resource plays provides additional data. In addition, our production forecasts and expectations for future periods are dependent upon many assumptions, including estimates of production decline rates from existing wells and the undertaking and outcome of future drilling activity, which may be affected by significant commodity price declines or drilling cost increases. Investors are urged to consider closely the disclosure in our most recent Annual Report on Form 10-K, available from our website at www.rangeresources.com or by written request to 100 Throckmorton Street, Suite 1200, Fort Worth, Texas 76102. You can also obtain this Form 10-K by calling the SEC at 1-800-SEC-0330.
About Range Resources

- Corporate Headquarters in Ft. Worth
- 800 employees and growing
- Pioneered and discovered the Marcellus Shale in 2004, America’s largest producing gas field
- Pioneered and played key roles in several other exciting plays across the country

Total Resource Potential
48 to 68 Tcfe without Utica Shale

- Marcellus Shale
  26 to 34 Tcfe resource potential
  Upper Devonian Shale
  12 to 18 Tcfe resource potential
  Utica Shale

- Midcontinent
  Mississippian, St. Louis, Cana Woodford, Granite Wash
  7 to 11 Tcfe resource potential

- West Texas / New Mexico
  Cline Shale, Wolfberry, Avalon/Bone Spring
  1.1 to 1.9 Tcfe resource potential

- Nora Area
  Berea, Big Lime, Huron Shale, CBM
  2.6 to 3.2 Tcfe resource potential
Range Resources in 2003

- Stock price ~ $4.00/share
- Market cap ~ $400/million
- Areas of operations:
  - Offshore Gulf of Mexico
  - Gulf Coast
  - Appalachia
  - Permian Basin
  - Midcontinent

- Strategy – growth through development drilling, traditional exploration and complementary acquisitions
Range’s Exploration Strategy in 2003

- Traditional exploration – high risk, theoretically high return

- Range’s portfolio:
  - Deep Woodbine East Texas
  - Norphlet onshore Mississippi
  - Offshore shelf GOM
  - Trenton Black River – PA + NY

- Probability of Success of Range’s prospects 10% – 20%

- Industry exploration history
  - if probability of success 50% - close
  - less than 20% ended up 5% or less

- In addition to being high risk, not repeatable – tough way to build Range
A New Strategy

- Look for opportunities that if successful, could become large scale and repeatable
- Resource plays – shale, tight oil or gas, CBM
- The challenge is once identified, could the economics be improved to bring the project to commerciality
- Challenge was made to Range exploration teams – great response. One of the ideas was the Marcellus Shale

AAPG Convention – May 2013
Bill Zagorski’s Idea

- 2003 drive to find the next Barnett Shale
- By early 2004 Bill was presented with a Neal Shale deal
- Eureka moment – the Marcellus compares favorably to Barnett, much larger, but it was in Appalachia
To Test or Not to Test – That is The Question?

Had an available wellbore, the Renz #1

- Failed Lockport, Salina, Oriskany tests
- Marcellus was uphole
- Well was being plugged and abandoned
- A lot of the surface reclamation was complete

Engineering/Operations Point-of-View

- Tired of the Renz #1; had spent a lot of money un成功fully
- Common knowledge for decades; Marcellus was water-sensitive
- Large Barnett style water frac would “lock it up”

Bill Zagorski

- The Marcellus compared very favorably to the Barnett in many ways
- The Marcellus had much more upside than the Barnett; covered a much larger area
- The Renz #1 had great gas shows in the Marcellus
- Other wells in the area had great shows in the Marcellus
To Test or Not to Test – That is The Question?

Continued...

- Conventional wisdom
  - Do not test; it won’t work
  - It’s been tried before, albeit with smaller jobs
  - Decades of drilling through it shows it’s water-sensitive

- Bill Zagorski
  - Compares well with Barnett; lots of great gas shows

- Decision
  - Put a big Barnett style water frac on it
Reflecting Back...It was one of the best decisions of my life!

Renz #1, discovery well completion, October 2004
Key Lesson #1

- Creativity with strong scientific basis tops conventional wisdom
Renz #1 – The Discovery Well, October 2004

- Initial test
  - Acceptable
  - High Btu gas
  - Lacked infrastructure

- After shut-in for one year, it began producing to sales
  - Discovered the aging process
  - We were in the wet window; better economics
  - Established high pressure gradient/over-pressure

- Drilled two offset wells to the Renz #1; the Deiseroth #1 and the Renz #2

Renz #1, discovery well drilling, October 2004
Decided to pump Barnett style water frac

Didn’t “Over Science it;” didn’t design specifically for Renz #1
   - Ask Barnett service company for a “typical job”
   - Designing most likely would have resulted in a much smaller job – Marcellus in the Renz #1 is about one third the thickness of the Barnett

Range at this point was a small Appalachia operator
   - Common practice – pump small job, keep costs down
   - New idea with risk – reduce financial risk with small job
Decided to pump a large Barnett style water frac

Large jobs were successful on the Renz #1, #2 and Deiseroth #1
- Encouraged and moved forward to drill more wells

Small jobs may have been one-third the size; may have resulted in a much lower rate and reserves
- Poorer results may have discouraged us

Early success, beneficial for small company, which Range was in 2004
“Why Make Billions When You Can Make Millions?”

- Range’s history in Appalachia; drilled a lot of Clinton and Medina wells, which typically made ~150 mcf/d initially

- Drilling the Marcellus on air, we encountered flows of 1,000 to 10,000 mcf/d in shallower formations

- Team wanted to stop and complete each one

- “Don’t give up; what will drive our company is the Marcellus”
Could We Make It Work Horizontally?

- Vertical wells worked, but key to growing and building Range was for the play to be horizontal

- Conventional wisdom pops up again
  - Got lucky with the vertical wells, but horizontal would never work
  - Marcellus is water-sensitive, you’ll never be able to drill it successfully

- Decision - the target was large enough and the risk was worth taking - we moved forward and took the “unconventional path”
Key Lesson #2 – FOCUS!

- First three Marcellus horizontal wells cost a lot and were not very good
- Vertical Marcellus wells worked, especially relative to the Clinton and Medina wells
- Our office at that point in time was in Hartville, Ohio
- Local pressure
  - Discontinue horizontal drilling
  - Make Marcellus a vertical program
  - Continue to drill Clinton and Medina
- Answer – FOCUS – Open a Pittsburgh office whose sole purpose was to make the Marcellus work

Ray Walker, circa 2007
Ray Walker Opens Range’s Pittsburgh Office

- **Early 2007**
  - 1 person Pittsburgh staff
  - Basin lacked equipment, technology and expertise
  - Marcellus ~ 0.001 Bcf/d

- **Spring 2013**
  - 350 employees and growing
  - PA is a leader in equipment, technology and expertise
  - Marcellus is ~9 Bcf/d

Southern Marcellus Shale Division 2012
From 2004 to the spring of 2007 - Range had invested ~$150 million

First 3 horizontal wells - not commercial

Range in July 2003 - maximum risk investment ~$3.0 million in a project

Deadline/Budget
  - We had decided that we would invest up to $200 million max and set a deadline of year-end 2007
  - In the spring of 2007, we had $50 million and eight months left to figure it out
Zagorski Scores Again!

- First three horizontal wells
  - 20 mcfp/d
  - 250 mcfp/d
  - 600 mcfp/d

- Engineering - longer laterals, more stages, more sand, different perforating charges and methodology, etc?

- Bill Zagorski - famous three point correlation
The Famous Three Point Correlation

- Well #4
  - Breakthrough well - 3.2 Mmcf/d
  - Equivalent of a good Barnett well

- Lesson from Bill
  - Don’t wait for more data to at least look for correlations

Maximum Vertical Height above Onondaga vs. Peak Initial Rate
Horizontal Marcellus Shale Wells
Washington County, PA

R² = 0.98
After “cracking the code,” drilled 3 more successful wells in a row: 3.7, 4.3 and 4.7 Mmcfepd

Press release on December 10, 2007, with results of these wells

Early 2008, Terry Engelder gave estimate of Marcellus reserves, showing immense potential

Shortly after, Range completes its 8th horizontal well for 14 Mmcfpd!
$150 million invested in the project by spring of 2007 was huge for Range.

One of Range’s key strategic elements – operating strategy driven company rather than a financial strategy driven company.

Financial strategy driven could have interfered with the creative process by imposing strict risk allocation components.

Operating strategy driven allowed capital to follow operating success and disciplined R&D.

Range stayed focused long enough to get the breakthrough we were looking for.
We proved the concept and realized the play covered a large area

Needed to focus leasing
  Bill creates the “Rosetta Stone” with core area called the “tenderloin”

We had an elephant by the tail
Key Lesson #3 – DO THE RIGHT THING

- Early on, “best engineering practices” exceeded existing state regulations and added $200,000 per well

- Local experts - state regulations are adequate

- Range decision
  - Do the right thing
  - Move to “best engineering practices”
  - Inform state and other operators

- Pennsylvania today has modernized all regulations and has some of the best in the country
The Risks were Not Just Technical

- Spring 2008, play was taking off
- Needed to recognize the Environmental and Social Concerns
- Range worked on getting best practices adopted by Pennsylvania
- Ray Walker initiates Marcellus Shale Coalition
Recycling Frac Water – That Will Never Work

- Historical wells produced very little water and no disposal capacity
- Range Engineers; let’s recycle
- Conventional wisdom
  - It won’t work
  - Additives won’t work in saline water
  - Risk of formation damage and a poorer well
Range Engineers
  - Began to reduce and/or change additives
  - Greener fluid
    - 99.9% water and sand

- Reduced water required for fracturing
- Reduced the need for disposal wells
- Less expense and better economics
- Pennsylvania now recycles a very high percentage of its frac water

"We are recycling 100 percent of the flowback water, which is between 15 percent and 30 percent of the water used during Marcellus Shale well drilling," said Ventura. A typical well drilled in the Marcellus Shale formation uses new horizontal drilling technology that uses millions of gallons of water to fracture gas-containing shale thousands of feet underground and may return 600,000 gallons of water to be recycled.
We’ve Got a Good Product and Process – Let’s Talk about It!

- In 2010, Range became the first company in the industry to disclose what’s in its frac fluid
  - 99.9% water and sand
  - 0.1% chemicals which are found in everyday household use
- The vast majority of industry has now followed

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**THE WALL STREET JOURNAL.**

**Natural-Gas Driller to Disclose Chemical Use**

WEDNESDAY, JULY 14, 2010 - VOL. CCLVI NO. 11

By Russell Gold

Range Resources Corp., says it plans to disclose the chemicals used to hydraulically fracture natural-gas wells in Pennsylvania, confronting rising pressure from environmental groups worried that drilling could contaminate drinking water.

The decision, which Range said was voluntary, satisfies the mounting demand that energy companies be, especially at the wake of the oil spill in the Gulf of Mexico. Even before the offshore spill, the industry was facing increasing scrutiny as gas drilling in the Marcellus Shale spreads across Pennsylvania and neighboring states.

In a significant break from past practice, Range says it will begin submitting a detailed list of all chemicals and additives, and the volumes, used to fracture each of its gas wells for state regulators. "There has been so much misperception about the Marcellus, we think it's prudent to begin making this information public," says John Pakucko, chairman and chief executive of the Fort Worth, Texas company.

Range holds leases for 3.3 million acres in the Marcellus and is in the ability to develop the gas to central to future growth. "It's the right thing to do morally and ethically, but it's also right for our shareholders," he says.

Range plans to make the disclosures with state Department of Environmental Protection within 30 days of "frack" jobs, and post the information online.

The decision was praised by environmental groups and some members of Congress who have proposed a law to require similar levels of disclosure.

The industry has resisted disclosing the chemicals it uses, although that has been erosion in recent months. Exxon Mobil Corp. Chairman and Chief Executive Rex Tillerson told Congress earlier this year he "wouldn't object to any disclosure."

Leakage gas molecules from drained shale rock require shutting a well, then pumping thousands of gallons of fluid under high pressure to crack the rock open. Range used 8.5 million gallons in a simple fracture of a recent well, the overburdening marine being water, according to a sampling of the disclosures provided by the company. It disclosed smaller amounts of chemicals such as sodium hydroxide, ethylene glycol, hydrochloric acid and benzalkonium chloride.

Range says the purpose of disclosure was to dispel concerns that chemicals added to fracturing fluids are a risk. The fluid is being pumped a mile beneath the groundwater and is 99.9% water and sand, the company says. And the chemicals are "compatible to household chemicals in a very diluted form," says Ray Walker, a Range executive.

Some politicians and environmental groups that support increased use of natural gas as a cleaner alternative to coal have expressed frustration with the industry’s disclosures. Sen. Well, a former Democratic senator from Colorado who has been a prominent advocate for natural gas, says the industry's push for secrecy is making it harder to win over skeptics.

"It’s a no-win, no-disclosure," Mr. Well said. "That’s the price of admission in this day and age."

Amy Mall, a senior policy analyst with the Natural Resources Defense Council, says the industry has used hundreds of different chemicals in fracture fluids in the past. She said the disclosure will help homeowners who have been trying to figure out what chemicals to look for when they grow suspicious that their water wells had been contaminated.

Also, John Range, secretary of the Pennsylvania Department of Environmental Protection, said he was pleased with Range’s new policy. "If your company can do it, everyone can do it and should do it. The leaking back of information in this area has fueled public suspicions."

Jan Jarrett, president of Citizens for Pennsylvania’s Future, an environmental advocacy group, applauded Range’s disclosure program as "a step in the right direction."
The Marcellus Shale is Now The Largest Producing Gas Field in the United States

- Range discovered the Marcellus back in 2004
- Renz #1 came online in 2005
- First cryogenic plant came online late 2008, industry production less than 0.1 Bcfpd
- Now, four and half years later, the Marcellus is producing about 9 Bcfpd
- A field typically includes all horizons. Adding in the potential of future Marcellus, Upper Devonian and Utica, Marcellus may become the largest field in the world.
The Marcellus Shale is Now The Largest Producing Gas Field in the United States

- Marcellus Play Potential – 84 TCF/3.5 Billion Bbls liquids (USGS 2011) to 489 TCF (Engelder PSU 2009)

- Consider the resource potential of the Genesee Group and Utica/Point Pleasant intervals

- Shale is truly a global game changer

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Table Sources: Global Natural Gas Reserves - A Heuristic Viewpoint
Raphael Sandrea, 2006

Size refers to ultimate recoverable reserves expressed in trillion cubic feet
What’s the Significance of this Discovery and the Shale Revolution in General?

1. US reserve life index has increased dramatically
What’s the Significance of this Discovery and the Shale Revolution in General?

2. US natural gas prices competitive
What’s the Significance of this Discovery and the Shale Revolution in General?

3. Potential rebirth of American manufacturing
What’s the Significance of this Discovery and the Shale Revolution in General?

4. Natural gas feedstock potential for US petrochemical industry
What’s the Significance of this Discovery and the Shale Revolution in General?

5. Shale revolution extends to oil
6. EIA – US supplying about 84% of its energy needs, oil imports drops to roughly 40%
What’s the Significance of this Discovery and the Shale Revolution in General?

7. Changing how we generate electricity, dramatic environmental and health benefits
What’s the Significance of this Discovery and the Shale Revolution in General?

8. EPA: 14% decrease in toxic air emissions from last reporting period in Mid-Atlantic, double the 20-year CO2 reductions of the rest of the Kyoto agreement in one year
What’s the Significance of this Discovery and the Shale Revolution in General?

9. $113 billion annual utility savings for total US consumers; in PA alone public health savings due to lower emissions $14-$37 billion annually
1. Analogy was to the Barnett, Marcellus is now superior with better wells and a much larger field.
2. Marcellus wells continue to improve and impress
3. Marcellus transforming how gas moves in the US
4. Marcellus significant source of NGLs, USGS: estimates 3.5 billion barrels recoverable in the play
5. Range of potential outcomes from failure to success (P99-P1)
6. In addition to Marcellus, triple pay potential with Upper Devonian and the Utica/Point Pleasant
7. In 2003 $4 stock with a $400 million market cap. Today about $74 stock with about $12 billion market cap. Assuming 80-acre spacing per well, only drilled 6% of our Marcellus acreage
Who’s Responsible?

- Bill Zagorski
- Ray Walker
- John Applegath
- Greg Davis
- Matt Pitzarella
- Scott Roy
- Doug Bowman
- Andrew Tullis
- Curt Tipton
- Martin Emery
- And many, many others…

- Roger Manny
- John Pinkerton
- Mike Forrest
- Alan Farquharson
- Shawn Hodges
- Dave Styles
- Jim Funk
- Mark Whitley
- Jim Morris
Thank You