2011 SENATE NATURAL RESOURCES

SB 2144

2011 SENATE STANDING COMMITTEE MINUTES

Senate Natural Resources Committee
Fort Lincoln Room, State Capitol

SB 2144
January 27, 2011
13572

☐ Conference Committee

Committee Clerk Signature Veronica Sparling

Explanation or reason for introduction of bill/resolution:

Relating to authority of the industrial commission to provide matching grants for applied research at North Dakota higher education institutions to increase the recovery rate or percentage share of oil recovered from geologic formations in North Dakota; and to provide an appropriation

Minutes: Testimony Attached

Chairman Lyson opened the hearing on SB 2144.

Senator Grindberg, District 41, introduced the bill. Last fall he spoke to the team at NDSU and Dr. Alfred Joseph who is an expert in this field. There is potential for extracting more oil from the ground. That discussion led to this idea. The Industrial Commission is the proper place for this project. He introduced Dr. Phillip Boudjouk, VP for Research at NDSU.

Senator Uglem: Do we have more than one company interested in this grant system at this time?

Senator Grindberg: I understand that we are in the first step of this. Dr Joseph could answer that.

Senator Triplett: Page 2, lines 3-6, do you think we need that section concerning confidentiality? Isn't that already covered in statute?

Senator Grindberg: The intent was just to reinforce it.

Senator Schneider: Would this allow for collaboration between the 2 universities?

Senator Grindberg: I believe that potential could exist.

Dr. Philip Boudjouk, VP for Research at NDSU. NDSU has been working on a program called the micro sensor systems program. In cooperation with Crane Wireless out of Seattle and Killdeer Manufacturing in ND they have developed man in motion sensors. These have been used in Afghanistan, Iraq, the US/Mexican border, and in Jordan, and in other places not yet published. NDSU is into small things in a big way; they are interested in miniaturizing everything. We have developed these sensors to gather data, then to feed it

into a computer where the data can be analyzed. We have the technology for use on aircraft and naval vessels already. We now need to develop the technology to use them underground at high temperatures and high pressures. There are some promising leads in this technology. NDSU is the sole robotics technology licensee with the Symyx Corporation. They are going for real time down-hole imaging of oil wells. We have an already funded computer center. The computer center is funded by the Dept. of Energy, and will hire a director soon. This computer center collects "a Mount Everest of data" every day, and evaluates it, and makes it permanently accessible and useful. Based on hard data coming out of the ground, you can know as you are drilling what you are coming up on. This is an area where NDSU can establish a beachhead in technology. With this precise data, you can be much more productive by reducing the number of failed drillings and increasing the yield coming out of the ground. Right now you are basically drilling blind. Even a 1% increase in yield has phenomenal economic consequences. It was a surprise to find the military project had underground relevance. It was Dr. Al Joseph and his team that made that connection.

Dr Al Joseph: He shared his background in imaging. It used to be GE and Westinghouse that were leading in technology. Now it is Intel, they have taken over because of innovation. What he is presenting today will have a huge impact on the whole country.

Dr Al Joseph gave a power point presentation. See Attachment #1. Audio23:30-53:00. Companies are drilling for easy oil and abandoning the well as soon as it is not easy oil, leaving most of the oil behind. The environment below the surface is very hostile, high pressure, high temperatures, water, acid, salt, etc. All is very unstable. There is no way to get oil out and leave everything else. It just isn't going to happen. Any time there is an action on our part, there is a reaction and they can't predict what it will be. Today's technology forces you to be reactionary; with this new technology, you can be proactive. We need to be careful not to make the same mistakes that Texas has made.

Senator Triplett: We can see that this is a good idea, but would you tell us why the legislature should put money into it? Why do you not sell it to the oil companies and have them finance it?

Dr Al Joseph: The reason the oil companies have not come up with it is that they are driven by profit. We will eventually be going to oil companies and to the federal government. When we start productizing it, that is the time to do it. This is not the stage at which you can bring in investors.

Chairman Lyson: Can you get to what you do to make us see what is under there?

Dr Al Joseph: Why at NDSU? It is the only entity that can take it forward. There is nowhere else in the country that has all the pieces to do it. Industry gives you averages. This gives you exactly how many molecules there are of everything. No one has ever done that before. Roy Long, Dept. of Energy, said without this technology we are not going to get very much out of the Bakken field. The vision we have is: This could be the Silicon Valley of Energy here in ND. In the MSS program the sensors all talk to each other. They work as a symphony. You can take all information and predict what will happen. Let's not be

reactionary, let's be proactive, get all of the oil and safeguard the environment while we are doing it.

Raymond Madden, a well doctor from Odessa,Texas. They fix wells that are broke. They may have 40 possibilities of what is wrong and bring them down to 2 or 3, then take a guess. This technology will help with that. NDSU will develop it, and then market it. Companies will want to do research; they will become customers. As long as the industry can go after the low hanging fruit, that is what they are going to do. There will come a time to involve others but this is not that time. We need a facility to simulate down-hole conditions to test the technologies.

Dr Al Joseph: There will be 3 divisions of the company: one in San Jose, one in Dallas, and one on NDSU campus. We have to get beyond 8% of the oil out. I am recommending we work together as a team. What can we get from Federal, from State?

Neutral Testimony: **Ed Murphy**, ND Geological Survey, presented neutral written testimony on behalf of Lynn Helms. See **Attachment #2**. Looking at the Bakken, we feel there is 169 billion barrels of oil, even a 1% increase in production would be an additional 1.69 billion barrels.

Senator Triplett: North Dakota already has an Oil and Gas Research Council. The applications are processed through the Industrial Commission. I think we are funding that for 8 million dollars in the current biennium.

Ed Murphy: 4 million in the current biennium.

Senator Triplett: I object to the state legislature micromanaging these agencies. I don't understand the need for this bill. If we want to do more research, why would we not simply increase the appropriation to the Oil and Gas Research Council and let this kind of presentation be made to the Industrial Commission which has the expertise for making decisions. Why would you come to this committee which doesn't have the expertise to decide between this project and some other project and ask us to put our stamp on one project? Would this project work through the system that's already there if there was more money in place to fund it?

Ed Murphy: I would assume this project would come before the Oil and Gas Research Council next biennium.

Senator Triplett asked Senator Grindberg the same question she just asked Ed Murphy.

Senator Grindberg: That would be a probable route. I felt this was worthy of a legislative hearing because the oil and gas industry is exploding in our state.

Chairman Lyson: Closed the hearing on SB 2144.

2011 SENATE STANDING COMMITTEE MINUTES

Senate Natural Resources Committee
Fort Lincoln Room, State Capitol

SB 2144
February 3, 2011
13974

☐ Conference Committee

Committee Clerk Signature Veronica Sperling

Explanation or reason for introduction of bill/resolution:

Minutes: No Attachments

Chairman Lyson opened the discussion on SB 2144.

Senator Triplett: I would suggest that we change the bill to increase the appropriation to the Oil and Gas Research Fund and let the Industrial Commission make the decision on which projects they ought to finance, or we should kill the bill.

Senator Hogue: I'm in support of killing the bill. I think this is a branching off of the Centers of Excellence Program. I don't see the need for this legislation.

Senator Triplett: What is the appropriation for the Oil and Gas Research Council within the Industrial Commission's budget? It was 4 million in the last biennium and it was my opinion last time that we should have increased it to 8 or 10 million dollars. I wouldn't mind using this as a vehicle to increase their appropriation but if it is already being requested somewhere else I will let it go.

Chairman Lyson: One of the things that bothered me was sticking more money into NDSU and though I like to see our colleges do that, this one bothered me.

Senator Triplett: It is not up to us to earmark it. Others can make a more informed decision on this.

Senator Uglem: I'm kind of torn; are we doing work for private industry or are we cooperating with private industry to get work done? I'm not sure if we are in a good position to define that.

There was discussion about how do you make these decisions? We are already funding the Centers of Excellence Program and it could be done through that program.

Senator Hogue: Do Not Pass Motion

Senator Triplett: Second

Roll Call Vote: 5-2-0

Carrier: Senator Hogue

Date: 2-3-11
Roll Call Vote # 1

2011 SENATE STANDING COMMITTEE ROLL CALL VOTES
BILL/RESOLUTION NO. 2144

Senate Natural Resources Committee

Legislative Council Amendment Number _____

Action Taken: ☐ Do Pass ☒ Do Not Pass ☐ Amended ☐ Adopt Amendment

☐ Rerefer to Appropriations ☐ Reconsider

Motion Made By Hogue Seconded By Triplett

Senators	Yes	No	Senators	Yes	No
Chairman Lyson	✓		Senator Schneider		✓
Vice-Chair Hogue	✓		Senator Triplett	✓	
Senator Burckhard	✓				
Senator Freborg		✓			
Senator Uglem	✓				

Total (Yes) 5 No 2

Absent 0

Floor Assignment Hogue

If the vote is on an amendment, briefly indicate intent:

REPORT OF STANDING COMMITTEE

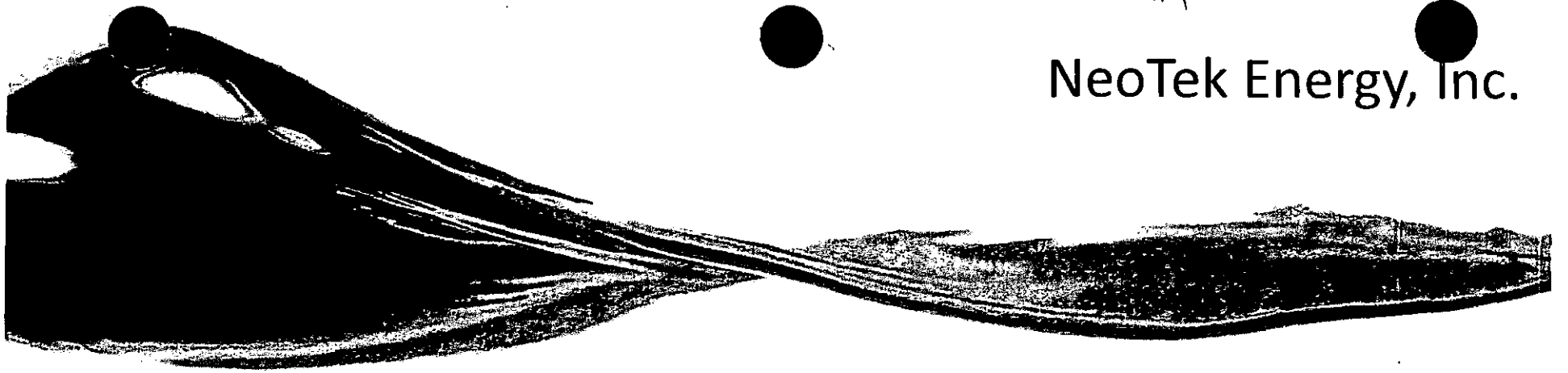
SB 2144: Natural Resources Committee (Sen. Lyson, Chairman) recommends **DO NOT PASS** (5 YEAS, 2 NAYS, 0 ABSENT AND NOT VOTING). SB 2144 was placed on the Eleventh order on the calendar.

2011 TESTIMONY

SB 2144

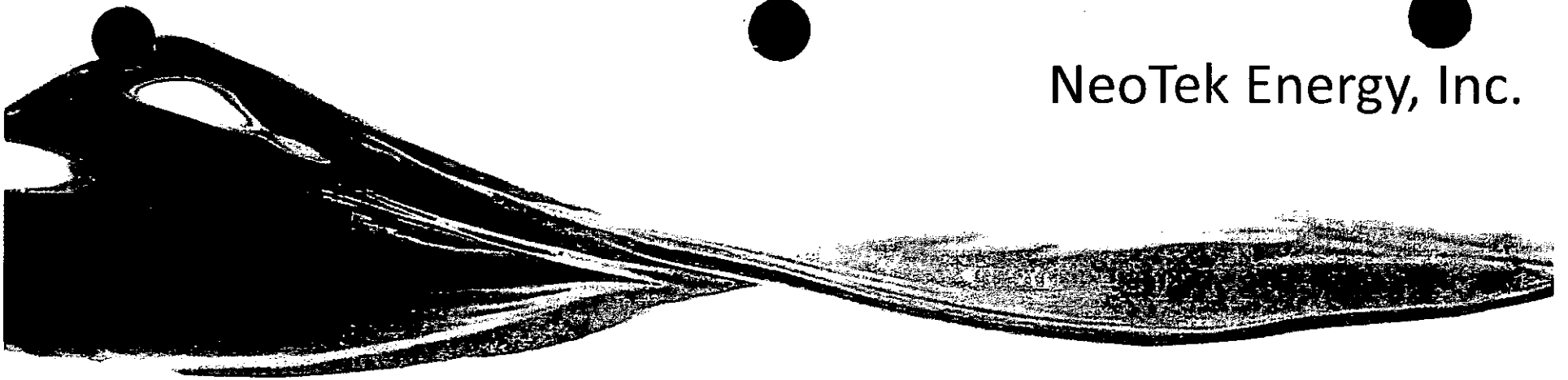
#1

NeoTek Energy, Inc.



Down-Hole Imaging

… transforming knowledge into more oil

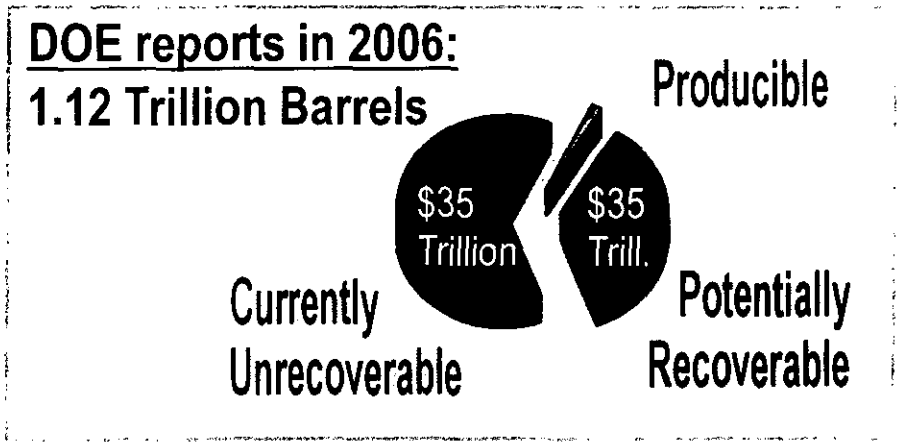


Background

Conventional Production Technologies

- **After 100 years of the "Easy Oil"**
  - 70% of the original reserves still left behind
  - 1.2M wells in Texas and Oklahoma have costly problems
  - US Oil Industry driven overseas by Wall St. economics

- **We can solve the problem!**
  - Lots of oil
  - Lots of technologies
  - Still lots of money



Down-Hole Environment

- **Very Complex**
  - High Pressure / High Temperature
  - Complex rocks & fluid compositions in unstable equilibrium
  - Salts, sand, gasses, oil, water, acids, …
- **Guess-work is pregnant with production problems**

➢ **What does it take to get "ALL" that Oil out ???**

"We cannot drill our way out"
–T. Boone Pickens

What do we need to do

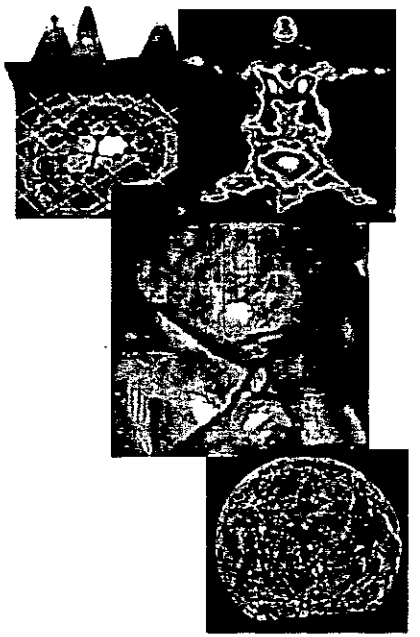
- **Total understanding in accurate details**
  - Complex structure of that environment
  - Production models based on complete suite of real data leading to Intelligent Production Process

➢ **Leave NO oil and NO problems behind**

"In North Dakota every 1% increase in production translates into 1 Billion barrels."
-Lyn Helms

Imaging

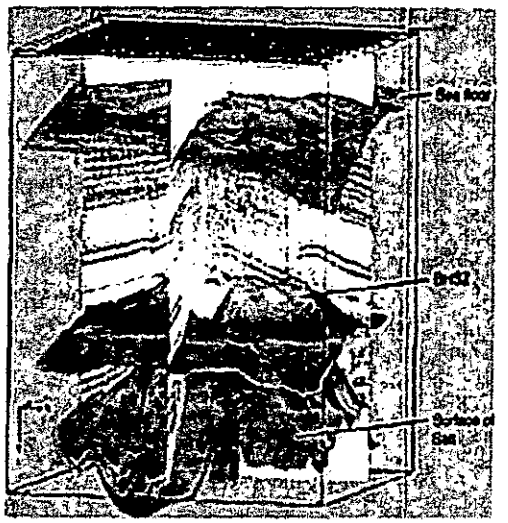
- No other tool has been more effective
  - Millions of miles into space
  - Sub-nano into the atom
  - 2 billion transistors in less then $4cm^2$
  - Internal medical diagnostics & surgeries
  - Security: Military, national security, public, commercial, others



- Nearly all of science's theories in physics, chemistry, bio, astro are based on data derived through "imaging"

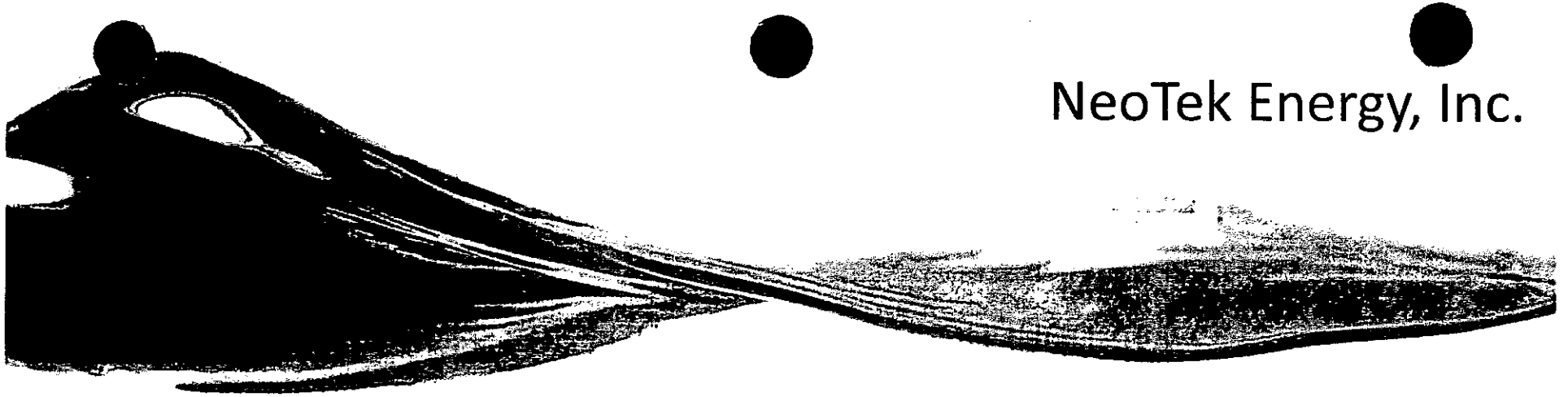
Down-Hole Imaging

- Coupled with existing high-tech
  - Modeling
  - Intelligence
  - Robotics
  - Communication
  - High-temp electronics
  - Corrosion-resistant materials



- We have all The Technology Pieces to revolutionize our energy production industry

➢ Imaging is The Critical Missing Ingredient



NeoTek Energy, Inc.

Breakthroughs

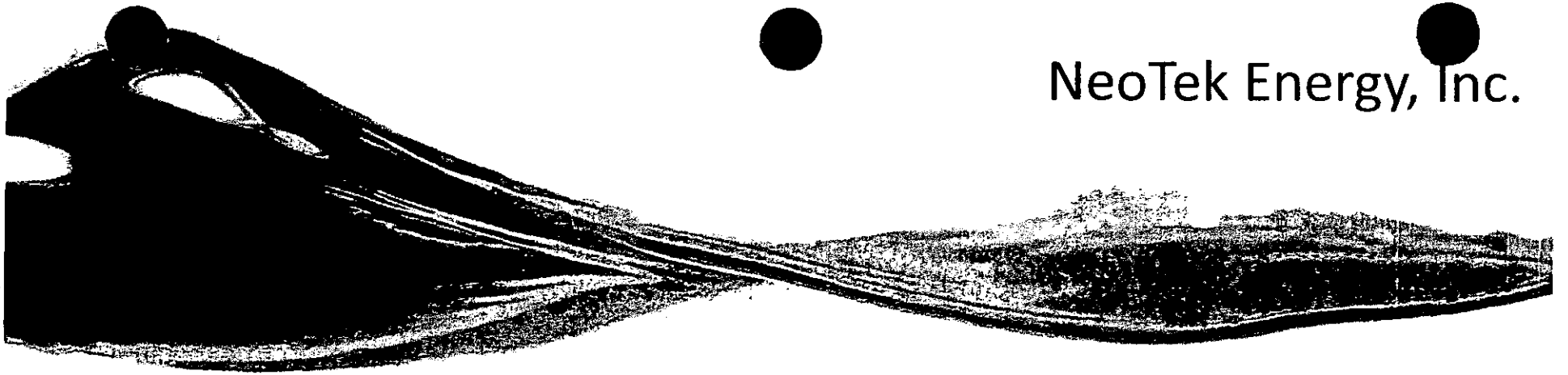
Someone Up There Did Something

1. **Chemical sensors for down-hole applications**
   - 2008: Discovery at Symyx (Miro Petro)
   - 2010: Symyx non-existing, effort splits into different directions
2. **Strong foundation for further sensor development**
   - 2002: Transition of combi to polymers (Phil Boudjouk)
   - 2010: After some $150M, NDSU is a global leader in Combi-Technology
3. **Multi Sensor System Program (MSS)**
   - 2002: Crane and NDSU founded MSS for military applications, $70M
   - 2010: #1 imaging tech. in Afghanistan, Iraq/Jordan & US/Mex border
4. **Slim downhole high-temp tools**
   - 25 years of downhole electronics development (Raymond Madden)
   - 2010: World-class hands-on experience with downhole applications

Powerfull Combination

1. Chemical sensor discovery is the ENABLER
2. All of NDSU's CNSE is applicable to down-hole
3. Nearly all of the MSS know-how can be used in oilfields
4. Slim tools technology for quick adoption

➢ These are the critical ingredients to integrate in down-hole imaging

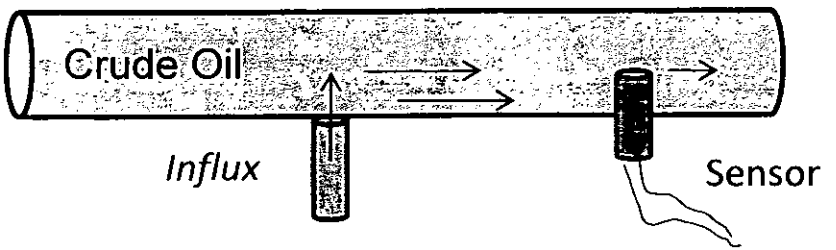


Discovery

Downhole Simulations

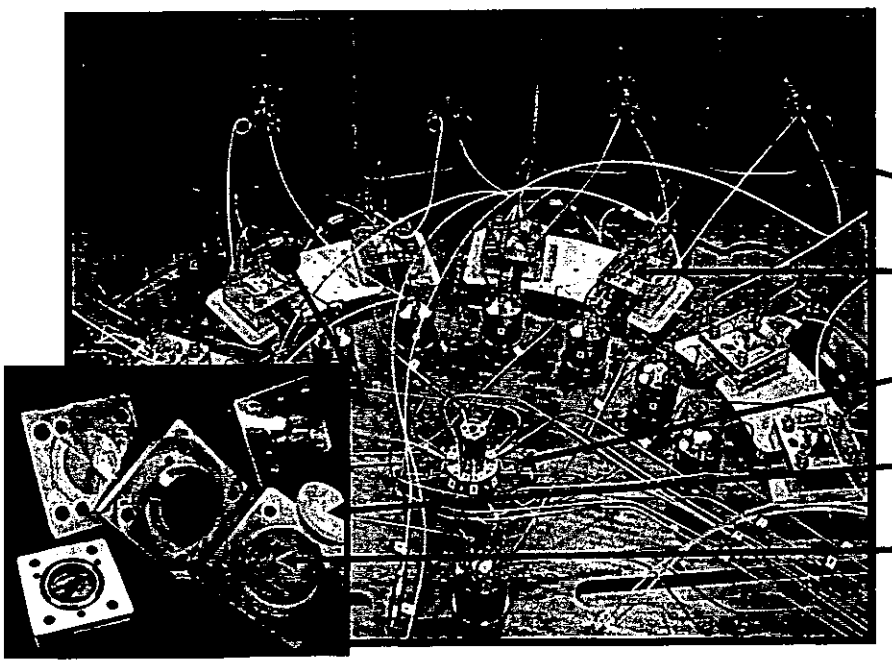
Mimicking situations at downhole conditions

Inject:
- *Water*
- *Hydrocarbons*



- Sensor optimization, materials hardenning, or rock-fluid interaction studies

- Temperatures up to 600 F
- Pressures up to 3,000 psi



Actual Equipment

Fluid Injections

High Pressure Cells

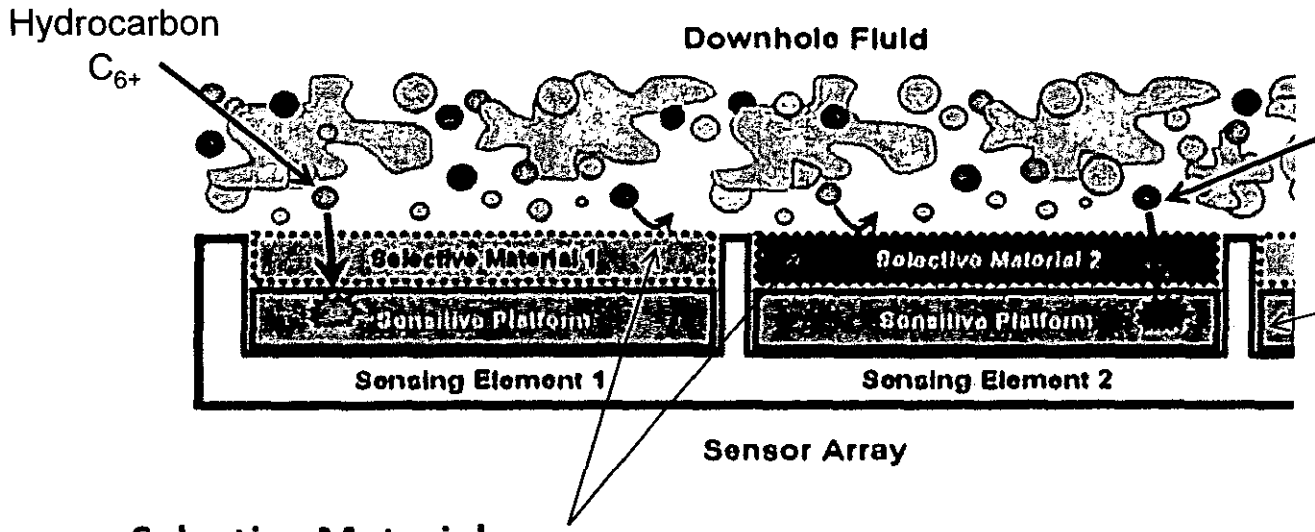
Post-Analysis

Rock Sample

Detection Array

Discovery of Rugged Chemical Sensing

- Capable of molecular recognition under extremely harsh conditions



Detection Platform

- electrical in nature

or

- optical fiber-based

Selective Materials

- tuned to respond to specific group of molecules

- functioning over a wide range of extreme conditions

Diffusion Coefficient (Molecular Size)

Chemical Potential (Molecular Polarity)

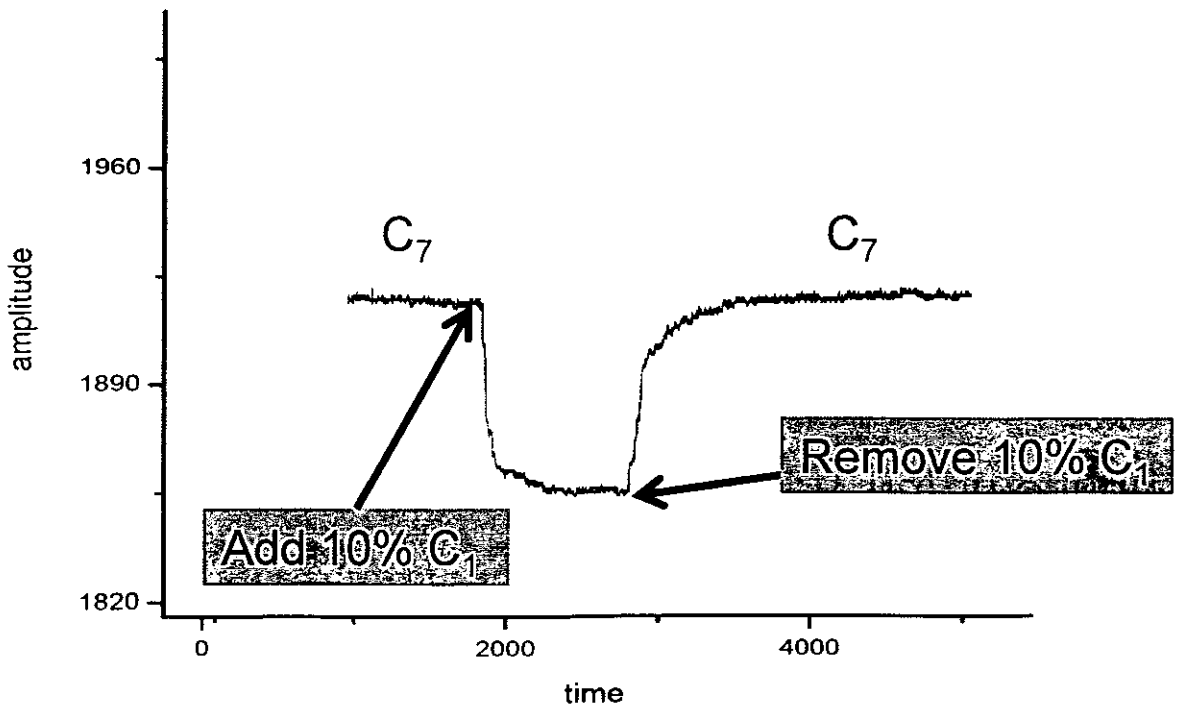
Mobility of Component A (Sensitivity)

$$\Gamma_A = D_A \left(\frac{\partial \mu_A}{\partial \ln x_A} \right)^{-1}$$

Relative Content (Concentration)

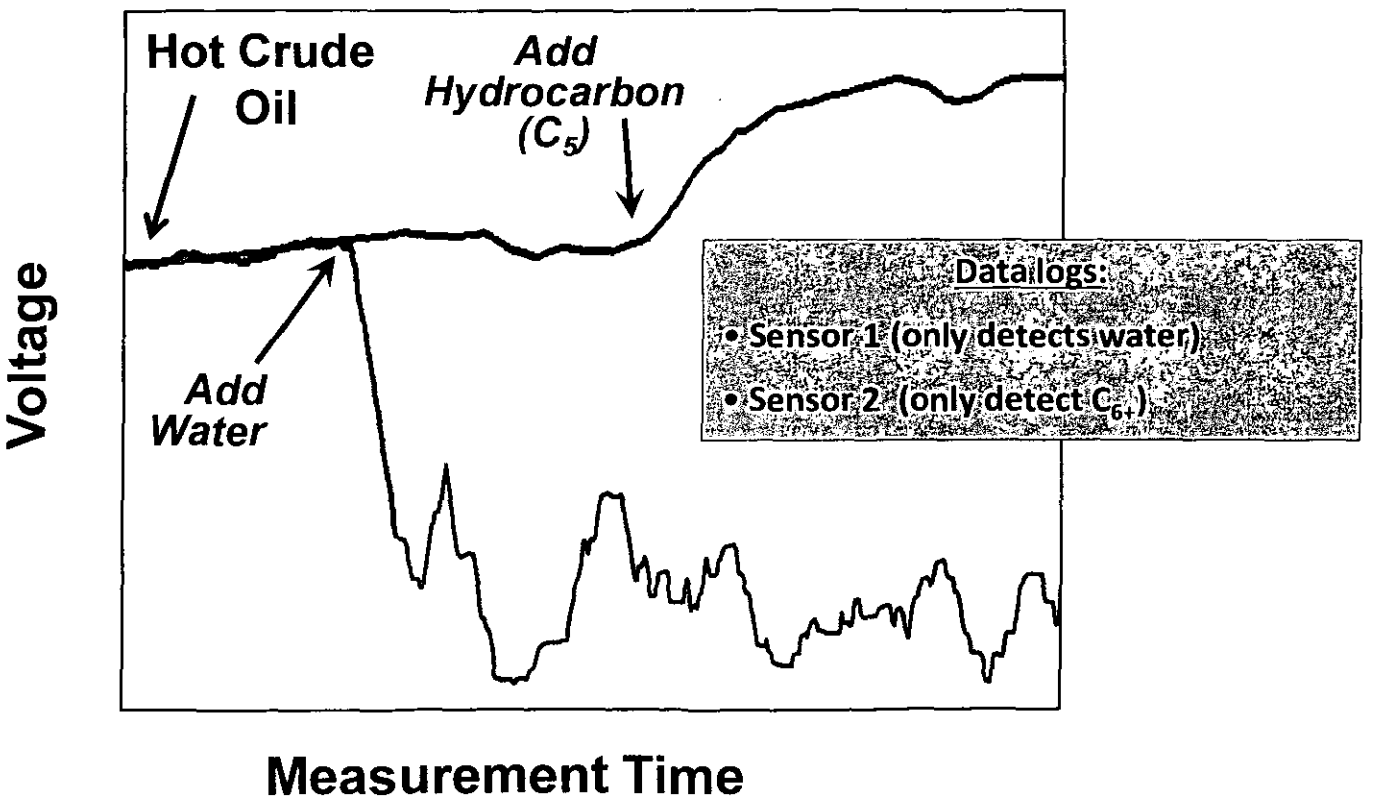
Sensor Response Specificity

- Single Element Sensor
  - Real time detection of specific molecules
  - Prompt response recovery



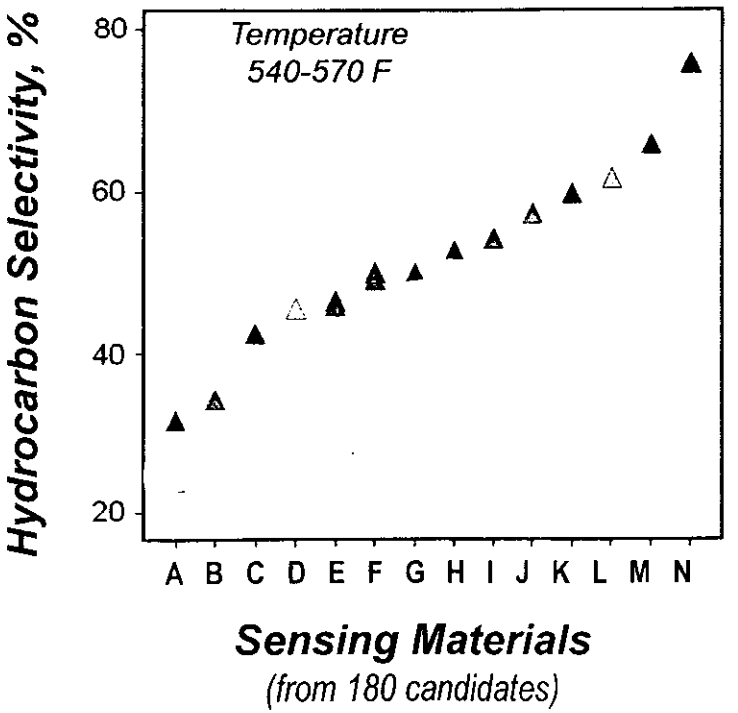
Multi-Phase Selectivity

- Two Element Array
  - Real time detection of hydrocarbons and water



Scope of Sensor Capabilities

- Technology capable of detecting all the important downhole fluid components



Whole range of hydrocarbons can be detected

Selectivity chart:

↓ ***polarity***

- methane	- waxes
- CO_2	- aromatics
- water	- asphaltenes
- metals	- naphtenics
- H_2S	- salts

molecular size →

Broadly diverse molecules can be detected

A Word from the Tech-Field

- **For too long we have operated down-hole in the "Dark"**
- **"Guesswork" is no longer an option**
  - Too costly in the long run
- **There is a compelling need to**
  - Understand in total down-hole environment
  - Deploy all available technologies
  - Develop Break thru down-hole Imaging Tech
  - We "Gotta" "See"; and we can
- **Let's go beyond the 8% mindset & get ALL**

John Yearwood, former CEO of Smith Intl.:

"… SEE would be extremely important in the quest to maximize the ultimate hydrocarbon recovery …"

Significance of Discoveries

- **Tip of the iceberg and eventually**
  - New families of down-hole materials
  - Complete suite of sensing devices and support electronics
  - Here we leverage about $250M from previous programs

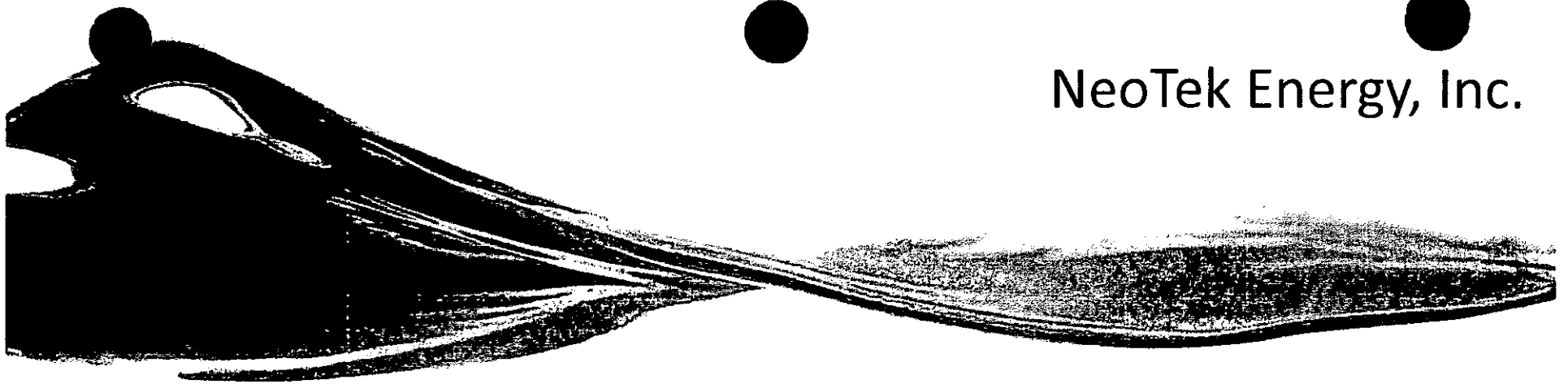
    ➢ All of these will eventually lead to the near term Imaging System

- **Once we have the Imaging System**
  - Could marry it with the intelligence robotics ($ Billions already invested)
  - Could predict and controll the production process to avoid problems

    ➢ We can intelligently manage the oil extraction economically again, for US to become globally competitive

Significance of North Dakota

- **North Dakota can emerge as a premiere energy state**
  - Potentially, leading extraction technology in USA
  - "A Silicon Valley Oil/Gas Extraction Capital"
    - 2011 North Dakota is where San Jose was in 1967

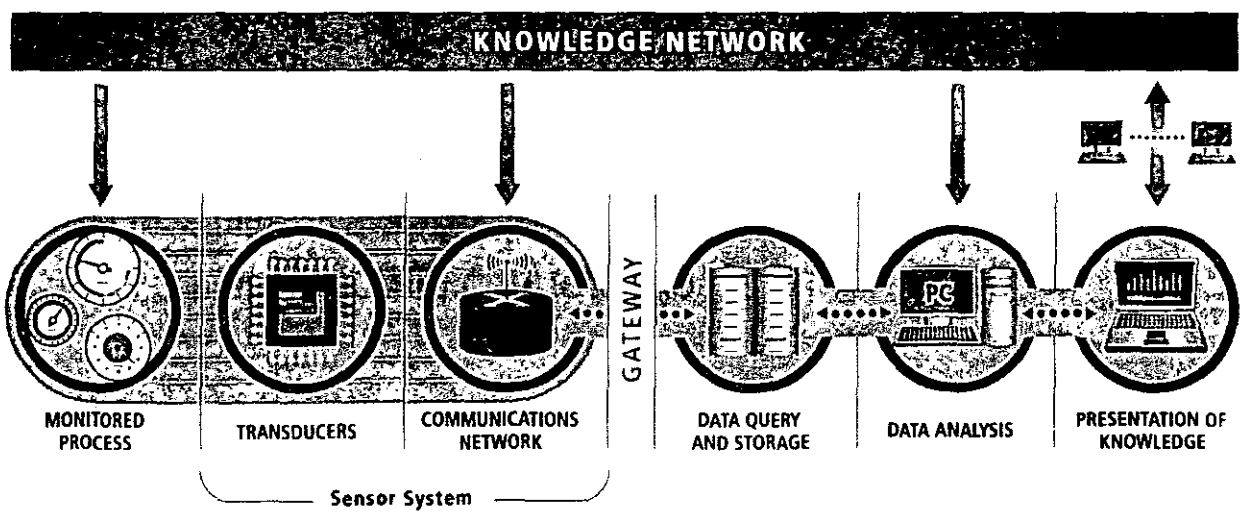


NeoTek Energy, Inc.

Neotek System

Knowledge Network

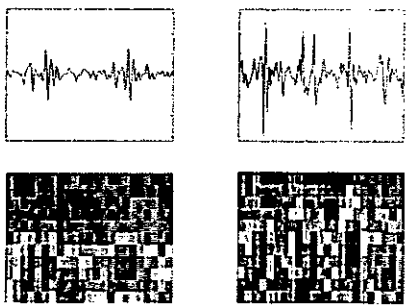
- **The Neotek system is a knowledge network**
  - monitoring individual wells as well as whole oilfields
  - sophisticated sensors to collect data on molecular behavior of the fluid flow and other environmental conditions
  - communicate this information for further analysis and present actionable information for the purpose of increasing oil and gas extraction



Micro Sensor System (MSS)

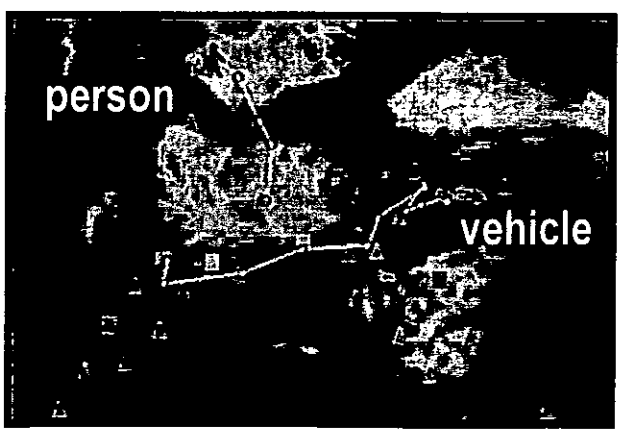
- The MSS was a DoD program chartered to revolutionize the military's ability to gain situational awareness of threats within their area of interest. The MSS product line, called MicroObserver, has become wildly successful with thousands of units deployed to protect US soldiers globally. The MSS is a Knowledge Network. Its mission is to provide information on human and vehicular activity to the user.

- The MicroObserver product line consists of up to 2000 sensors for each gateway, capable of real-time, 24x7 monitoring of an area of tens of Km^2.



Human Footsteps ***Canine Footsteps***

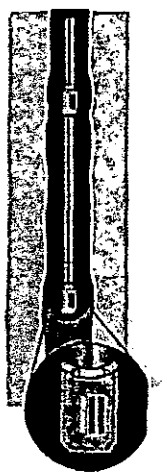
Advanced signal processing determines the difference between human footsteps and animal footsteps



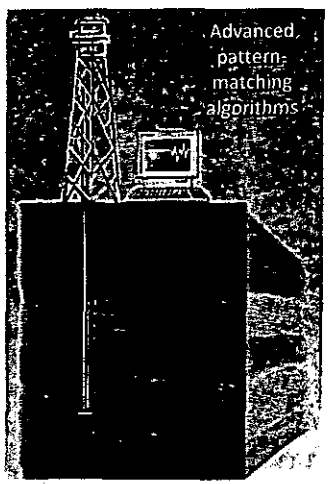
An actual picture of the MSS operator terminal showing sensors deployed over 100's of meters in a forested area. the right

NeoTek System

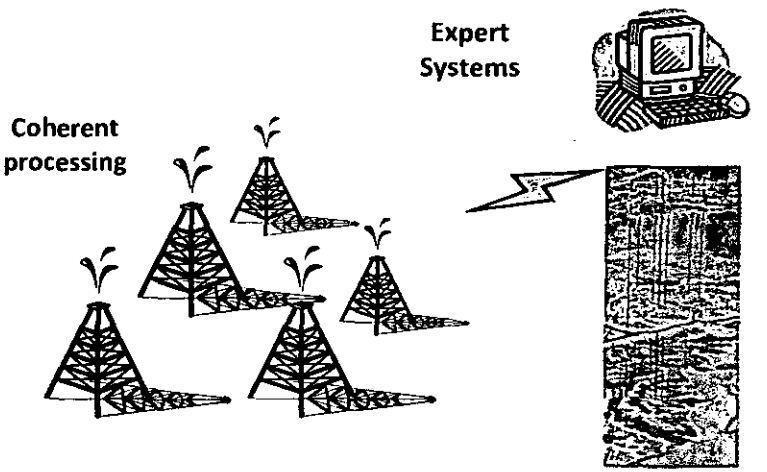
- Similar to MSS, the NeoTek system will sense its surroundings, it will use sophisticated detection and classification algorithms to create knowledge about each sensor's location.
- Each sensor will communicate its information to the NeoTek controller (gateway or Maestro) and the system will coherently process events to provide actionable information to the user
- MSS saves lives, Neotek will enable more oil and gas



Chemical Analysis Sensor Array



Unique down hole sensors enable unprecedented chemical spectroscopy

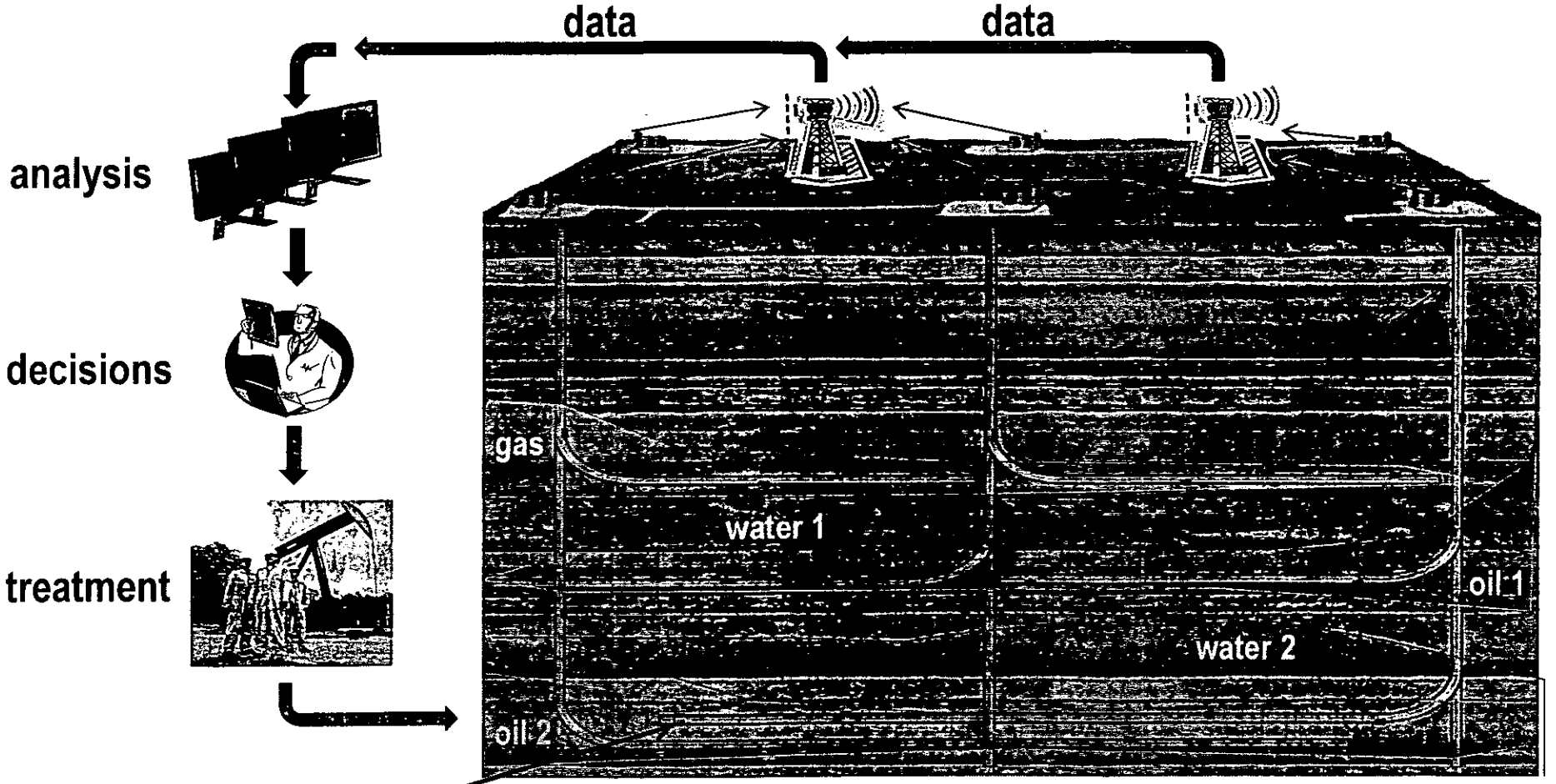


Distributed Networking

Visual Analytics

➢ **Intelligently integrating breakthrough technologies produces a real-time system with the capability to revolutionize the industry**

Real-Time System at Work



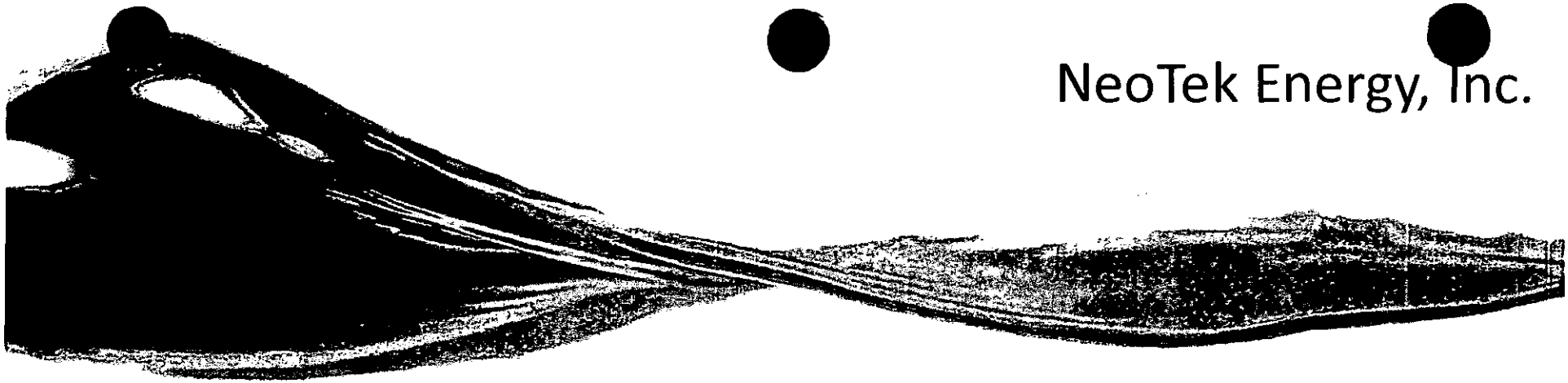
Ultimate system – Intelligent sensing network to monitor production flows and detect, identify and respond to any threat of undesired influxes before it becomes a problem!

Near Term System

- 2012: Imaging system
  - Monitors
    - Composition: oil, gasses, salt, sand, rock chemistry, water
    - Fluid flows: velocity of each type, source, pressures, temperatures etc.
  - Total coherency of detection
  - Data to develop production models
  - 2013: production prototyping – TX, OK
  - 2014-2015: Full deployment

Longer Term System

- **New World of "Intelligent Machine" or "Robotics"**
- **Dollar leverage in BILLIONS OF DOLLARS**
  - Existing vast resources in
    - Spectrum of s/w, controls, customization
    - Currently tested e.g. DARPA "Great Challenge" projects
    - Imaging was the enabling ingredient !
- **Add imaging to our oil equation**
  - A new world of "fully customized highly intelligent totally computerized system"

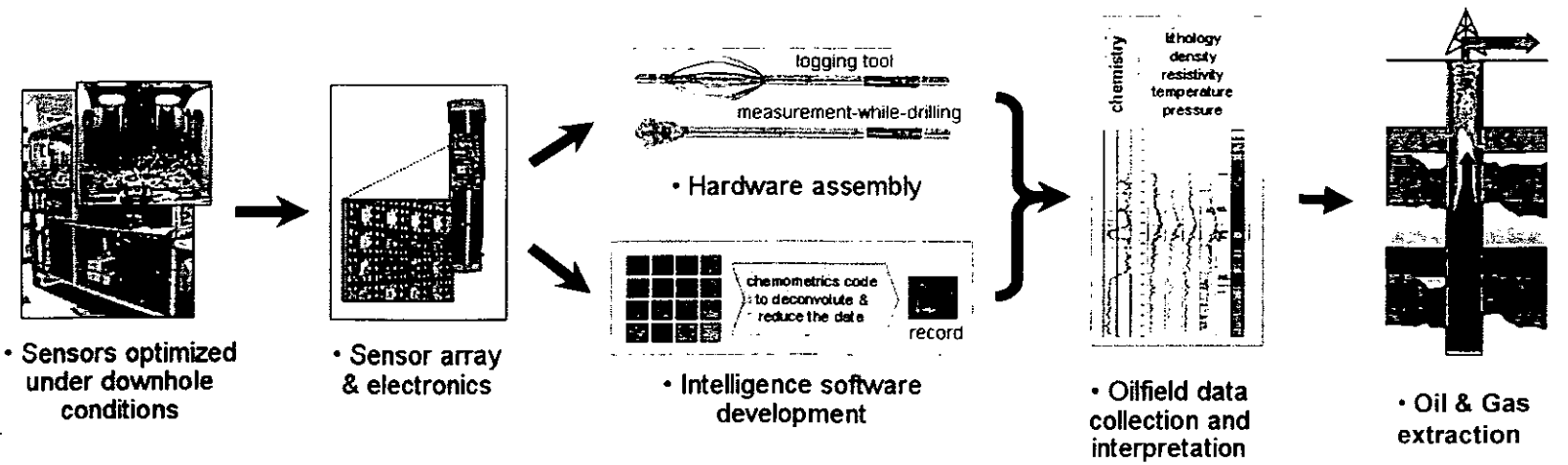


NeoTek Energy, Inc.

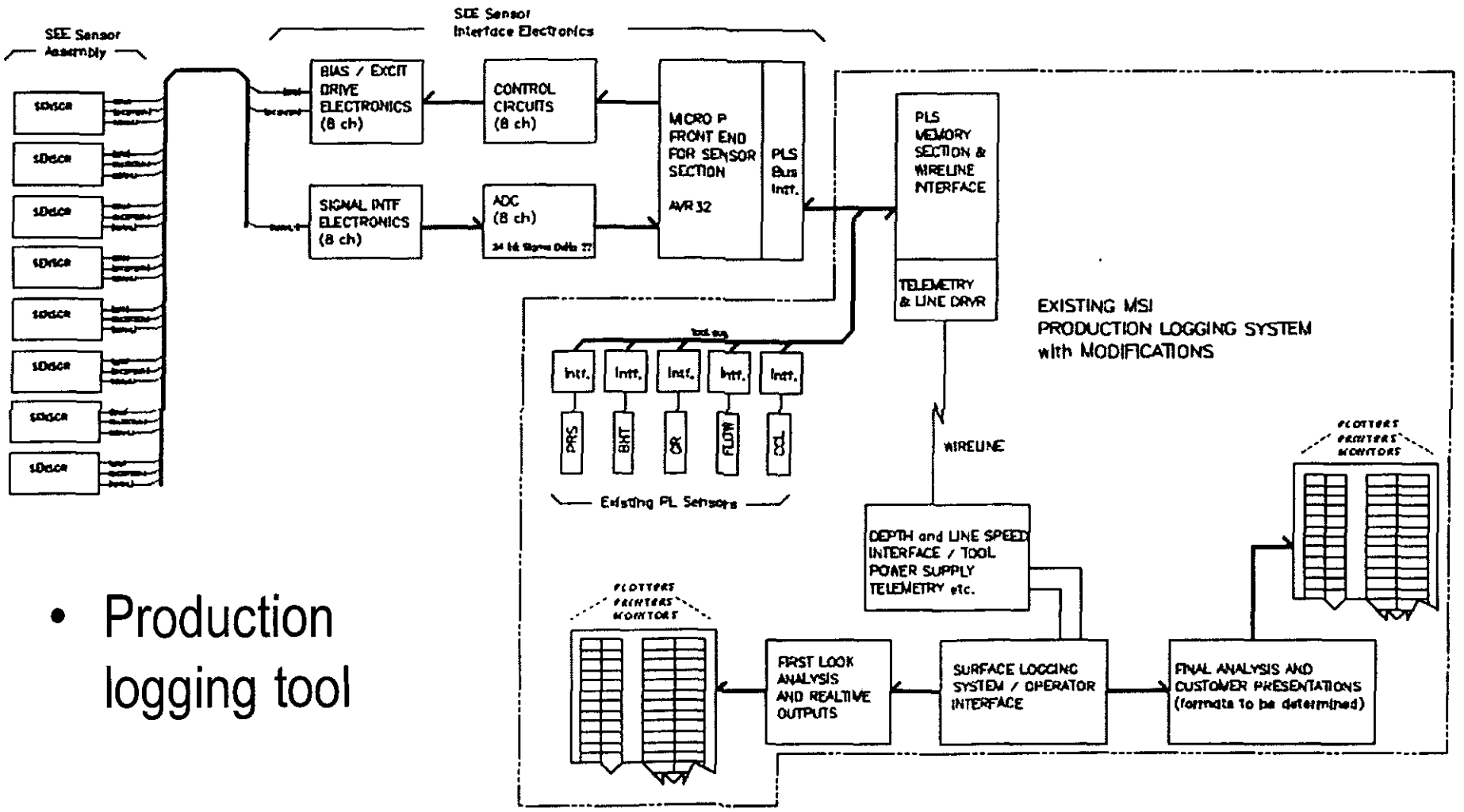
Technology Roadmap

From Sensors to Oil Extractions

- Sensors
  - Selective materials
  - Individual sensors and arrays
  - Sensing multiphase flows
  - Oil, water, gas phase sensors
  - Resolution within each phase
  - Laboratory simulation capabilities
- Systems
  - Device concepts
  - Downhole tools design
  - Packaging for high pressure
  - High-temperature electronics
  - Multi-Sensor Systems, Algorithms
  - Oilfield networking
- Extractions
  - Lab-tested methodology into fields
  - Modeling, predictions, solutions
  - Field testing, evaluation
  - Well fixing procedures
  - Automated response systems
  - New extraction methods



Initial Tool Schematics



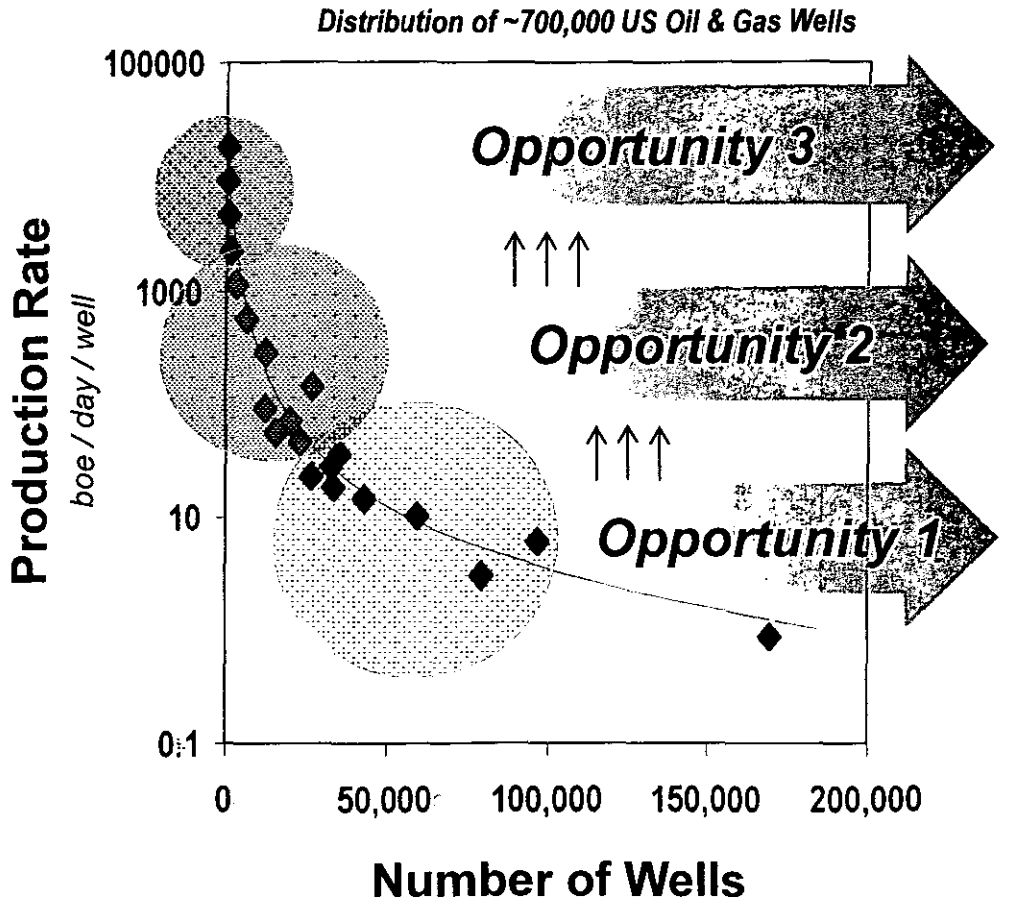
- Production logging tool

Algorithm Development

- Model
  - To define environment
  - Understand it's equilibrium parameters
  - Manage & control extraction
    - Minimize damage
    - Maximize production
    - Safeguard against any environmental problems

➢ Algorithms may become our key competitive strength

Road to Market



3) Reservoir Extraction

New recovery strategies for large oilfields owned by Big Oil

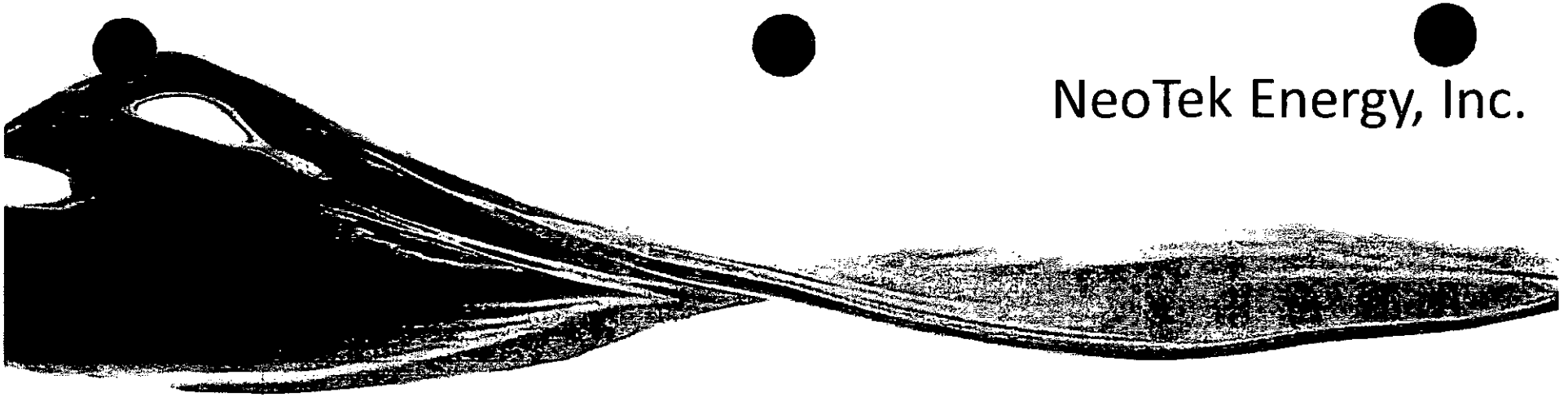
2) Field Enhancement

Improve production in small fields, partnering with independents

1) Well Fixing

Restore production in uniquely distressed small individual wells

"Low-Hanging Fruits" will prove our technology and lead us to a "Big Apple"



NeoTek Energy, Inc.

North Dakota and Texas Activities

Key Competences – Fargo

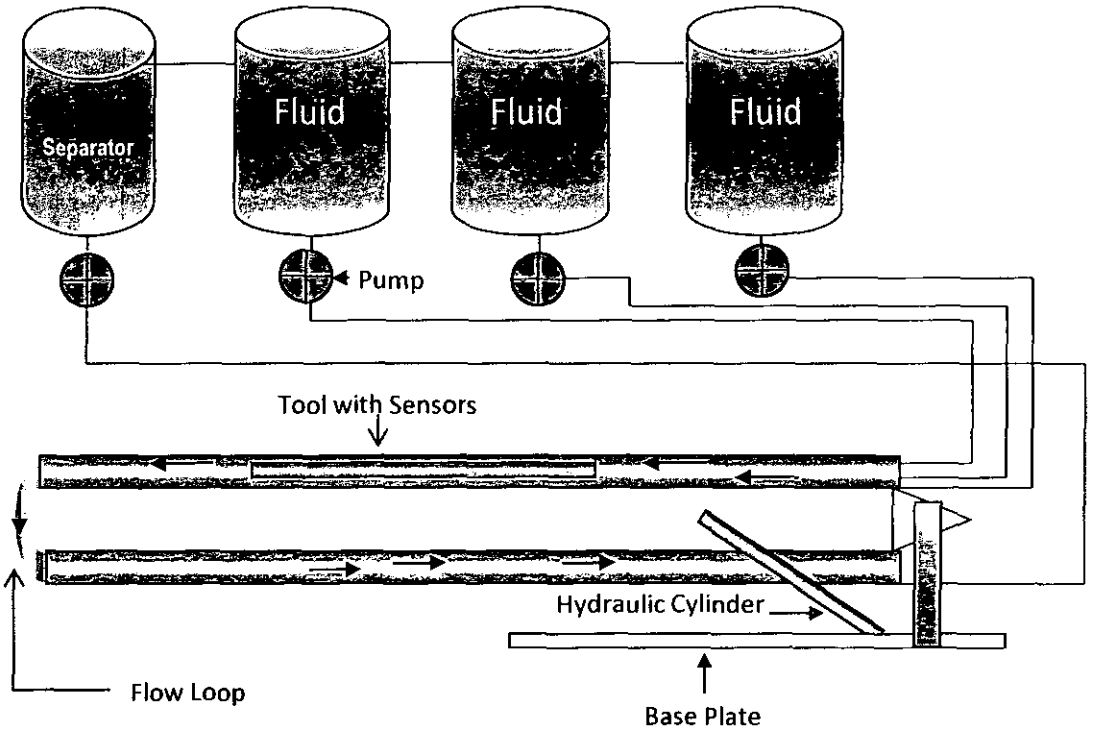
- **Materials screening**
  - Durable sol-gel matrix (silica, alumina, zirconia)
  - Selective organic filling (polysiloxanes, polyolefins,..)
  - Properties screening & Best materials selection
- **Electronics packaging**
  - Chip array miniaturization (substrate & electrodes fabrication)
  - High-Temp resistance (insulation and/or SiN components)
  - Sensor array module packaging (in-tubed under 1"x1')
- **Bakken oil extraction research**
  - Rock-fluid capabilities (real situations simulations)
  - Extraction methodology (reservoir stimulation, lower costs)
  - Oilfield demos (well access, production capabilities)
  - Focus on new fields / non-existing-yet wells

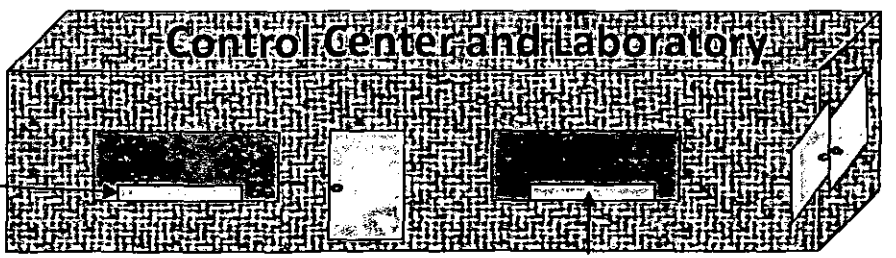
Downhole Simulation Lab

- **Suite of rock-fluid characterization systems**
  - Basic characteristics, plus testing under high-pressure/temperature
- **Lab units for multi-phase flow**
  - Mimicking the well and reservoir situations
- **Stimulation methods**
  - Experimenting using lab capabilities with reservoir specs/samples, and confront with downhole logs to vary parameters and propose field procedures
- **Extraction methods**
  - Optimization of extraction processes (both technical and economical parameters) using "downhole lab" and reservoir models
  - New methods based on maximum utilization of on-the-ground as well as underground resources (e.g rock chemistry instead of dumping chemicals)
  - Goal is to lower the cost of new oil to enable/extend extractability of a field
- **Bridging sensors and downhole fluids**
  - Incorporating new sensors into the "downhole lab" capabilities to test and understand their performance and maximize their use in the field

Flow Loop Testing

- Channel with several different fluids pumped into at various speeds and combinations.
- Tanks containing the fluids would be connected by hoses to base of flow loop.
- Returning fluids would be routed to a separator that would be heated and permit fluids to be separated by specific gravity.
- These fluids would then return to proper holding tanks.
- A building near the flow loop would house all the control mechanisms and would also contain laboratory facilities to monitor sensor readings, video flow regimes, and necessary experimental equipment.





Control Panel for Flow Loop and Pumps

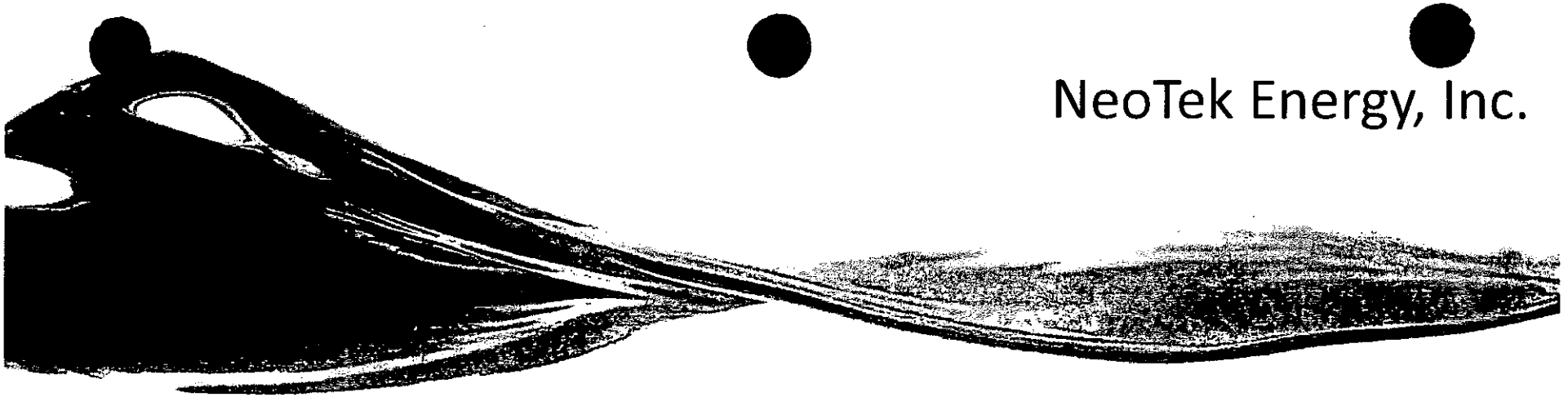
Control Panel for Sensor Data

Tool Hardening

- **Lab simulation**
  - sensor material optimization
  - sensor array exposed to downhole conditions
- **Flow loop testing**
  - tool prototype evaluation
  - simulated downhole situations
- **Shallow testing-well**
  - first downhole testing
- **Real deep well**
  - new tool proofing along ongoing production logging

Complementary Capabilities

	Materials	Sensors	Packaging	Syatem	Field Test	Lab Sim	Modeling	S/W Develop	Economic Analysis
NeoTek San Jose	✓	✓				✓	✓	✓	
NeoTek Dallas			✓	✓	✓		✓	✓	✓
NeoTek Fargo	✓	✓	✓	✓	✓	✓			
NDSU	✓	✓	✓			✓	✓		✓



Funding

Significance of Impact

- This vision will not be cheap
- Much will be done to capitalize on existing and proven technologies
  - Some pay-off will be realized in about 3 years
  - Substantial return in about five years
  - Major payoff after 7 years
  - Stop the out-flow of $500-700 Billion for foreign oil every year
  - Bring jobs and US petroleum industry back home
  - Do not compromise US national security
  - Ultimate goal to make USA totally energy sufficient

Concluding remarks

- Oil & Gas will be around for a long time
- North Dakota has the energy resources
- Critical technology pieces are now available
- Alternative energies are good but not enough
- ND's fields are mainly virgins
  - ➢ Must not be seduced into the "easy-oil" mind-set

Funding Strategy

- Venture Capital
- States
- Feds
- Industry

➢ The stakes are high, let's all work together

Last Words

- If you believe that we're taking the wrong path, don't support it
- If you agree that we're on a highly promising path, then lets do it right
- If the pay-offs are potentially as substantial as we think, then
  - ➢ The issue is no longer the cost of doing it, but the consequence of NOT doing it
- We need to work together to do this for our country and our children
- We have been talking ENERGY for over 35 years
  - ➢ ENOUGH IS ENOUGH

#2

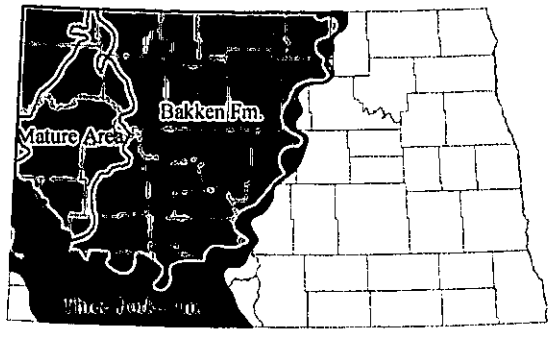
North Dakota Geological Survey

Edward C. Murphy - State Geologist
Department of Mineral Resources
Lynn D. Helms - Director
North Dakota Industrial Commission
https://www.dmr.nd.gov/ndgs/

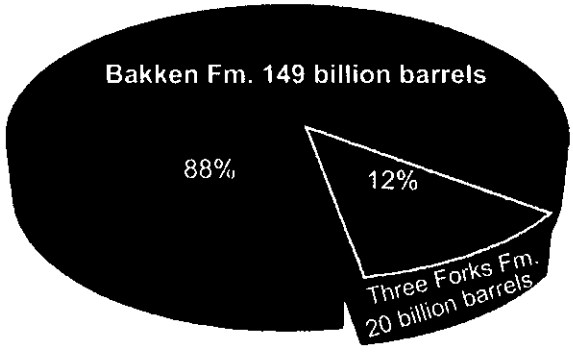
Senate Bill No. 2144

TESTIMONY BEFORE THE SENATE NATURAL RESOURCES COMMITTEE

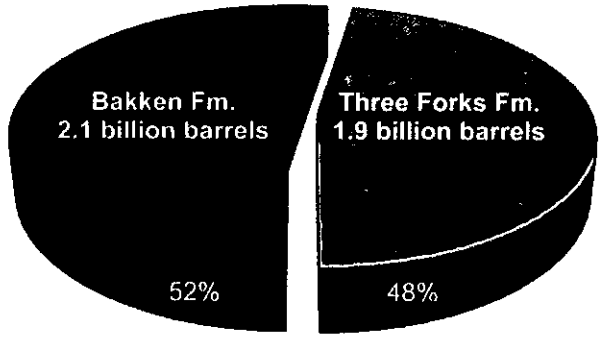
Ed Murphy
January 27, 2011



ORIGINAL OIL IN PLACE



EXPECTED ULTIMATE RECOVERY



ND DEPT OF MINERAL RESOURCE'S BAKKEN (**BAKKEN**) SOURCE SYSTEM ASSESMENT (2008)
Original Oil in Place = **149 billion barrels**

ND DEPT OF MINERAL RESOURCE'S BAKKEN (**THREE FORKS**) SOURCE SYSTEM ASSESMENT (2010)
Original Oil in Place = **20 billion barrels**

TOTAL BAKKEN SOURCE SYSTEM ASSESMENT (2010)
Original Oil in Place = **169 billion barrels**