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COLSTRIP COAL: DEVELOPING A WEBSITE TO COMMUNICATE A HIGHLY COMPLEX AND CONTROVERSIAL SUBJECT

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COLSTRIP COAL: DEVELOPING A WEBSITE TO COMMUNICATE A
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by

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Abstract

The purpose of this meta-document is to explain my project design, review its development and outcomes, and provide my reflections on the project. The project objective was to create a website that communicates vital information about the coal industry, Colstrip's coal-fired power plants, the potential closure of several of the plants, and the potential impacts closure would have on the community and the state. The project also discusses options to continue to use coal as an energy source and lower its impacts on the environment. The information on the website is thorough and presented in an interesting and effective method; using videos, photos and infographics to engage the audience. In this meta-document, I will provide background on my topic, the design choices I made and why, the processes I used to create a high-quality website, the problems I encountered, and my recommendations for future research.

Keywords: Coal, Colstrip, Environmental Communication, Web Design, Usability, Environmental Rhetoric

Dedication

I would like to thank my parents for their unwavering love, support and encouragement. They have always been my biggest cheerleaders and I am beyond grateful for everything they have done for me.

Acknowledgements

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1. Introduction

Communication about the environment has become pervasive in recent years, dominated by reports of a warming climate and emphasizing new energy resources and technologies being developed. This information is spread across TV news, films, newspapers, social media, and all over the World Wide Web. When I began to conduct research on coal and the Colstrip coal-fired power plants, I discovered the abundance of online resources and articles available. The dilemma that I encountered was that many of these online resources communicated the same information in a different context, had conflicting information, or the sites were missing pieces of information I needed. The news sites that I visited offered the same articles written with slightly different wording, but communicated the same information. There were many sites I visited that were coming from an environmentalist perspective and several that were coming from an industry perspective. These sites were taking a subjective approach to the topic of coal and the information was lacking, or contradicting the information I was reading from other sources. Because coal is a controversial topic and these sites were dedicated to communicating the pros or cons of coal, with the goal of influencing their audience, I was unable to find any resources that communicated all aspects of coal. This made it difficult to find answers to some of my research questions. Many of the sites were flooded with text and there were very few pictures or videos. I found these sites difficult to interpret and I read through multiple paragraphs of text just to find a few key points. Through this process, I realized how difficult it was to get a balanced perspective and some of the sites left me confused and frustrated. After that discovery, I decided to focus my research project on developing a website to communicate important information about coal in Montana and the community of Colstrip using an engaging and interesting design. My goal was to enable users to visit one site to learn about all aspects of these topics and cultivate a better

understanding of coal as a natural resource in Montana. This paper discusses my project

research, development, outcome, and the potential need for future research.

1.1. Background

Coal plays a vital role in electricity generation, currently fueling 41 percent of global

electricity (2016). Coal-fired power plants in the United States accounted for 33 percent of the

electricity generated in 2015. The use of coal to provide energy in the US has been declining in

recent years; what is causing this trend? The key factors are as follows:

- The falling cost of wind and solar energy and the increasing popularity of these "renewable" energy sources.

- The imposition of additional environmental regulations on coal-fired generating facilities.

- The abundance of relatively cheap natural gas from use of new oil and gas extraction technology (hydraulic fracturing).

The Colstrip Generating Station is the second-largest coal-fired power plant west of the

Mississippi, producing up to 2,094 megawatts of electricity to serve utility customers across the

Pacific Northwest. The plant has been a significant contributor to Montana's economy since the

1970s, creating over 700 jobs in the community of Colstrip and providing millions in tax revenue

for the state. However, over the last several years the economics of the Colstrip station have been

impacted by growing pollution control costs and a low market price for electricity in the Pacific

Northwest. Several owners of the Colstrip plants that serve customers in Washington and

Oregon are under increasing political pressure to move away from coal to renewables and natural

gas to generate their electricity. Talen Energy, the successor to PPL Montana that purchased

their share of the plants in 2015 is a merchant power producer, and therefore cannot pass along

increased operational costs to customers. These changes are all impacting the future viability of Colstrip Units 1-4.

In addition to the above factors, environmental activist groups have been challenging coal generation at every opportunity. The Sierra Club and the Montana Environmental Information Center filed suit in 2013 alleging violations of the Clean Air Act and that the Colstrip plants had avoided adding pollution control equipment by not going through proper air quality permitting. In 2016, Puget Sound Energy and Talen Energy agreed to shut down Colstrip Plant Units 1 and 2 by 2022 to settle that litigation.

The announcement of this partial closure has raised some major concerns from the community of Colstrip, as well as Montana lawmakers and businesses. According to a study done by Patrick Barkey, director of the UM Bureau of Business and Economic Research, losing Units 1 and 2 will result in the loss of hundreds of jobs, as well as a decrease of millions in tax revenue for the state. The situation is continuing to unfold in the 2017 Montana Legislature, with politics and economics playing a major role in the fate of coal. Options for Colstrip's future are being discussed, the possibility of adding carbon capture technology is being considered and lawmakers are deciding on bills that will aid Colstrip in this transition. Keeping the public informed as this important issue evolves is extremely important, and tools like the internet are an optimum way of communicating this information.

1.2. Research Questions

This graduate project sets out to answer the following research questions:

1. How can complex environmental information be effectively communicated?

2. How can technical tools like websites and videos be used to communicate this information?

3. What is coal and how is it mined? How does it generate electricity?

4. What is the history of coal mining and use in Montana?

5. How did Colstrip, Montana develop as a coal town?

6. What are the details of the Colstrip coal-fired power plant?

7. How are politics and economic conditions affecting coal in the marketplace?

8. What is currently happening in Colstrip?

9. What are the potential impacts of closing the plant to Colstrip and Montana?

10. What could the future of Colstrip look like?

1.3. Stated Thesis

The purpose of this project is to demonstrate the use of a website as a communication tool for a complex and controversial subject. The website aims to provide a thorough overview of coal as an energy source and uses the situation in Colstrip as a close to home example of what is happening with this natural resource. Understanding the use of powerful communication methodologies like rhetoric and semiotics and their influence on the way information is conveyed, it was important to be aware of their ability to persuade the audience. My goal was to develop a site with an objective presentation of coal in Montana, explaining the pros and cons of the subject. I chose to use words, images, and videos that could evoke either a positive or negative reaction from the audience. I also used effective web design methods, videos, photos, and infographics to allow engagement of viewers and help portray the technical and complex information in an interesting and appealing way.

2. Literature Review

Effective communication about protecting our environment is critical, but often difficult to achieve. There are many resources available that provide environmental information from nearly every angle. For this project, I focused my research on various communication methodologies, including rhetoric and semiotics. I started with the topic of climate change related to these methodologies to provide a better understanding on the power of words, images, and videos when communicating complex information on the environment. I also researched web based environmental communication, the history of coal in Montana, the Colstrip coal-fired power plant, and the community of Colstrip, Montana. These topics are tied together because concerns about climate change are driving changes in the production of energy, which in turn diminishes the role of coal as a dominant energy resource.

2.1. The Rhetoric of Environmental Issues

Environmental communication is an interdisciplinary field attracting scholars from diverse backgrounds such as rhetoric, technical communication, philosophy, and sociology (Coppola and Karis 2000). For example, various media sources have seized upon powerful rhetorical and representational tools and visual strategies in order to frame discussion about the reality of climate change (Daniels and Endfield 2009). An article from NRDC states, "For the sake of our children and generations to come, we have an obligation to reduce the dangerous carbon pollution that traps heat and is fueling climate change (Long 2015)." This statement represents a need to construct accounts of climate change policy in terms of both the 'national interest' and 'lifestyle maintenance' (Kurz, Augoustinos and Crabb 2010).

In 2015 President Obama and the Environmental Protection Agency (EPA) announced the Clean Power Plan, referred to as a historic and important step in reducing carbon pollution from

power plants. Those that oppose the Clean Power Plan proposed by the EPA have acquired the slogan "Just Say No" in an attempt to encourage legislation to opt out of the entire regulatory process (Seimi 2015). Some are more upbeat about the new regulations; one article states "EPA's Clean Power Plan gives states considerable flexibility to adopt beyond the fence line measures to meet their emissions reductions targets (Webb 2015)." Others respond to climate change concerns by trying to play both sides, such as British Petroleum's (BP) Helios Power media campaign, which both encourages and embodies capitalistic agency as the means to enact pro-environmental behavior (Smerecnik 2010). Various industry leaders, politicians and wealthy interest groups possess the resources that ensure the capability to continually reframe public discourse regarding power related issues and environmental concerns (Burns 2015).

Carbon capture technology is another energy related topic that can be portrayed in a very positive and technocratic frame (Asayma 2013). Research has shown that people's attitudes toward novel and complex technologies like carbon capture are largely influenced by how the properties of these technologies are framed in stakeholder communications and in the media (de Vries, Terwel, Ellemers, 2016). Emphasis framing can be particularly useful in this regard, as it focuses on presenting information in ways that a particular position is advanced over another, aiming to nudge people into that position (Chong and Druckman, 2007). Research has shown that many of the carbon capture articles available reported only on the positive or negative consequences of this technology. This type of communication can be perceived as manipulative, which is problematic when objectivity is expected. Being aware of these persuasive tactics can help communicators resist persuasion and people can more effectively use the information they read to develop an informed opinion about complex issues like carbon capture.

Understanding how rhetoric is used in environmental communication was an important part of my project research. The majority of websites I visited used rhetoric as a tool to convey a certain message to their audience. The "pro-coal" sites chose to avoid using images that portrayed coal as dirty and focused solely on spreading the message of coal as a vital natural resource and part of the economy. They avoided or downplayed the environmental impacts of coal and overlooked the challenges to coal's economic viability in recent years. The "anti-coal" sites used the same methodology in communicating the negative aspects of coal as an energy source. These sites focused primarily on explaining the environmental impacts of coal as well as the effects it can have on human health. They used photos of coal mining and power plants that appeared dirty and destructive to the environment. They avoided discussing the significant role coal has played in providing electricity as well as the research of clean coal technologies that could be part of using coal in the future.

After viewing these sites and their different approaches to communicating coal, I understood the power of rhetoric and how it could be used on my website. I wanted to include the pros and cons of coal and I aimed to not influence the audience. I explained in detail about coal mining and coal fired power plants, as well as addressing their impact on the environment. I chose not to go into explicit detail about climate change, because it is an endless subject laced with rhetoric and semiotics; it would be better served as a singular research topic. Instead, I focused on discussing the potential for using cleaner coal technologies and what the future could hold for coal through use of new technology to limit its impacts. I wanted the audience to develop a clear understanding of coal as a natural resource, and I chose to take a more optimistic approach to discussing the future of this resource.

2.2.   The Framing of Climate Change

The way in which climate change is framed – as an environmental, security, economic or social justice problem – fundamentally affects the way that climate is governed, the types of policy interventions that are sought, and the actors to be involved (Hulme 2009). One article suggests that research should be framed in a way that avoids prejudging the existence and outcomes of climate change; such prejudging on researchers' part may alienate laypersons that do not subscribe to the majority assessment of climate change and its effects and may cause others to respond in socially desirable ways (Heath and Gifford 2006). Political ideology plays heavily into environmentalism, research shows liberals to be more enthusiastic about improving environmental quality than conservatives, regardless of party affiliation (Lester 1995). Other variables such as religious identity, race, gender, and education have been shown to be significant regarding the perspective of citizens on the climate change issue. While careful research needs to be conducted to evaluate the effects of reframing the climate change discourse in security, religious, or economic terms, another article proposes the reframing of climate change discourse as a security or an economic issue might help to successfully communicate the climate change science across ideological divides (Heath and Gifford 2006).

Environmental framing is everywhere in the news. Understanding framing of environmental issues like climate change is important because it is intimately tied up with other issue areas like economics, energy, food, health, trade, and security. Communicating about environmental concerns can be done in a variety of contexts depending on the target audience. My website was intended to communicate information to the general public; it was not intended for any specific audience. With that in mind, I chose to reframe the topic of coal in economic, political, social and environmental terms. I believed that this would draw interest from all perspectives on this important topic.

2.3. The Semiotics of Environmental Films

The relationship between communication and the environment is critical, but difficult to explain. There are vast resources available that cover key environmental issues from every angle. The most significant environmental issue of our time is climate change. Visual rhetoric and semiotics guide the creation and interrogation of powerful symbols regarding climate change and ecological disaster. One effective way to utilize semiotics in communicating these vital issues is through film. Documentary film is a pragmatic art that possesses the gathering power of entertainment and the educational rhetorical power of images, sounds and words (Gregg 2011). Semiotic theory provides one avenue for the exploration – and potentially the construction – of the meanings and ideological issues which are communicated visually through film (Burgess 1990). Developing a solid understanding of this powerful communication tool and how it is used in environmental films is something that should be explored more in depth and carefully analyzed.

As stated by Umberto Eco in his article on the contribution of film to semiotics, it is not possible to understand the social relevance and the aesthetic functioning of a movie without focusing on it from a semiotic point of view (Eco 1977). Using semiotics, documentary film is a way of communicating or constructing particular realities through signs or codes. These can be specific cinematic codes (i.e. camera movement, lighting, and editing) or non-specific codes shared with other arts (i.e. metanarratives, visual analogy, and gender roles) (Metz 1974). Film deploys all three modes of signs, as defined by Peirce (Kindem 1979):

- Icon, through resembling images and sounds;
- Index, through sensory features that connect film with "reality"; and

- Symbol, in the deployment of culturally defined (though arbitrary) forms of speech and writing.

Scholars Lester and Cottle did a visual analysis of television news coverage of climate change. Within their visual analysis they classify the news visuals of climate change into the following three categories; iconic, symbolic and spectacular visuals. Here, iconic visuals are used to represent the issue of climate change; symbolic visuals are connotative of the potential impacts from climate change and spectacular visuals play with emotions, waiting for an implied response, whereby environmental destruction is portrayed or slow camera movements of natural landscapes are shown. These categories aid in depicting people or places as under threat within the visualization of climate change. These visuals create a sense of localism for a global issue (Cottle 1993).

Film communicates meaning denotatively and connotatively. What the audience sees and hears is denotative, the object and signification (mental understanding) is tied directly with the images and sounds so the viewer need not strive to recognize or construct meaning. At the same time these sounds and images are connotative and the way the scene is shot can evoke certain feelings or create mental associations for the viewer. Within connotations, paradigmatic connotations exist, which would be a shot that is being compared with its unrealized companions in the paradigm. For example, a low angle shot of a rose conveys a sense that the flower is somehow dominant or overpowering because we unconsciously compare it with an overhead shot of a rose which would diminish its importance. Syntagmatic connotation would not compare the rose shot to other potential shots but compare it with actual shots that precede or follow it. The meaning adheres to it because its compared to other shots we actually see (Monaco 2000).

Another powerful semiotic tool for videos or filmmaking is the use of metaphors. Climate change can be viewed as an idea, so metaphors obtain the potential to help people understand the complexities of climate change, mainly through incorporating it in human terms (Mathews 2015). Lakoff & Johnson regard framing an issue within human terms deemed as personification (Lakoff 2008). We personify nature in our everyday lives, for example saying the wind was whistling or the sun kissed the flowers. Here, personification helps to create a picture in our mind of how a particular subject would react if it was human.

Effective communication, such as the use of framing or the choice of an image, applies directly to web design; the structure of a website results in a user experience that can be quite different from conventional "texts" such as hard copy documents or film. The variety of available features on the web offer more engagement for the user and can help frame the material being presented. Applying semiotics to the web can help determine how meaning is derived from websites, and in turn how to better design sites to convey intended and desired meanings (Smart, Rice & Wood 2000).

A website can be thought of as a multimodal artifact that encompasses a broad array of signifiers, including typographical conventions, layout, photographs, graphs, diagrams, and other media (Warschauer and Grimes 2007). These signifiers all work together to communicate the intended message of the website. As I developed my website, it was important to select specific signifiers based on the information being communicated. I chose large, bold fonts for page and section titles so they stood out from the content. The layout is the same on every page and information is divided into sections based on the type of information. Background photos are included in each section to signify what is being communicated in that section. The photos and videos selected for each page act as icons because they all resembled the information being

represented. The logo for the website includes a coal cart and stacks from a power plant, both iconic representations of coal. These images and videos can also be considered indexical because they show evidence of what was being represented. Understanding how semiotics can be applied to web design to create meaning allowed me to create a website that is full of key signifiers.

2.4. Using Media Tools for Environmental Communication

Images and video play a significant role in the public communication of environmental issues given their capacity to reproduce and naturalize certain ways of seeing our world, communities, and identities (Takach, 2013). Communication about the environment continues to increase and spread as issues like climate change become a growing concern for the public. One of the most popular ways of sharing this information is through media – cable TV news, social media, films, YouTube, podcasts, websites, blogs and more. The public sphere is filled with competing visions, agendas, and modes of speaking, all of which influence people's understanding of and relationship with the environment (Cox 2012).

Powerful photographs, video clips, animations and infographics can shape how people perceive the environment and the actions they take. It is easy for messages to be misconstrued or for personal opinion to trump factual information. This can lead to further confusion and uncertainty about what is truthful, leading people into heated debates over the climate. Forums like the world-wide web provide great potential as a medium for communicating environmental issues and may give people the necessary resources to better understand information about the environment. However, the web can also be used to spread information and opinions that are not balanced or fact-based.

Research has shown the web to be the timeliest communication medium because information can be placed on it at any point in time, referred to as real time (Lodhia 2012).

Environmental issues are dynamic and websites provide the ability to update information and keep the public informed. The web also has presentation features, such as graphics, multimedia and animation, which are all valuable tools for web based communication. Hyperlinks and menus help organize the information and can provide access to further information when needed. People can query specific information using the search function on websites, electronic interaction is also available through discussion forums and comment sections on these sites. There is an abundance of useful features and tools available, with new ones being developed every day, making the web a more effective option for communicating vital information about the environment.

2.5.   The Story of Colstrip, Montana and Its Coal-Fired Power Plants

Colstrip was originally established in 1924 by the Northern Pacific Railway as a company town providing coal for steam locomotives. During World War II, the Colstrip mine was identified as strategically important because it supplied coal for the Northern Pacific Railway steam locomotives hauling military equipment for the war effort. The mine was guarded from sabotage, and the employees were not allowed to quit their jobs (McRae 2009). After the war the railroad switched to diesel locomotives and the Colstrip mine was shut down. In 1959, Montana Power Company purchased the rights to the mine and the town, and resumed mining operations in the 1970s with plans to build four coal-fired electrical plants. The power plants were built in the 1970s and 1980s and Colstrip quickly became a boomtown (Wikipedia 2016).

A partnership of Montana and West Coast utilities built the four Colstrip generating units. The Montana Power Company was the operator of the Colstrip Generating Station and was a fractional owner of three of the units. In 1998 Montana Power sold their share of the Colstrip station to PPL Corporation, which later becoming Talen Energy. The other owners include Puget

Sound Energy, Portland General Electric, Avista Corporation, PacifCorp, and Northwestern Energy.

Tax revenues from the plants help fund Colstrip's history museum, recreation center, golf course, schools and 32 colorful playgrounds (Harball 2016). According to the U.S. Census Bureau, as of 2010, there were 2,214 people, 863 households, and 622 families residing in the city. About 770 of these people work at the power plant or the mine complex that feeds it. Despite the positives of jobs and generating a massive amount of electricity for Montana and the Pacific Northwest, the U.S. EPA reports that the 2,094-megawatt Colstrip Generating Station emits nearly 15 million metric tons of CO_2 per year, placing it among the top 20 greenhouse gas (GHG) emitting power plants in the United States.

Primarily because of these GHG emissions and their tie to climate change, Colstrip is facing major threats to both industry and community. Much of the plant's power is currently transmitted to both Oregon and Washington, but the legislatures in these states see climate change as a reason to end their reliance on Colstrip's coal-fired electricity. Only one of the owners—the South Dakota-based regulated utility NorthWestern Energy—has a significant operating footprint in Montana. Four co-owners—Puget Sound Energy, Portland General Electric, Avista Corp. and PacifiCorp—are based in Oregon and Washington, left-leaning states trying to reduce their carbon footprints (Harball 2016). Legislation was recently passed in Oregon which will require utilities to stop getting power from Colstrip by 2030. In Washington, a bill was passed which allows for decommissioning Colstrip's two older plants by 2022. These two legislative actions and changes in the power market in the Pacific Northwest (reducing revenues for merchant providers like PPL – now Talen Energy) are driving dramatic changes in Colstrip's future.

The community isn't going down without a fight; its heavy dependence on a coal-based economy is creating a stir about job losses and the resulting economic impacts locally and at the state and regional level. A group called Colstrip United has created a Facebook page and website that supports coal and directs people to climate-skeptic blogs. Duane Ankney, Montana State Senator and Colstrip resident and other legislators have introduced legislation in the 2017 Legislature to provide support to Talen Energy, or alternately to require the companies retiring Colstrip units to provide support for workers losing their jobs and the community.

Environmental activist groups, like MEIC and the Sierra Club, denounce the Colstrip Generating Station and nearby mine and propose that Montana explore greener options to replace the coal plants. Alternative energy companies are jumping at the opportunity to explore renewable resource options to replace coal generation. Clearwater Energy plans a wind farm North of Colstrip with enough electricity to power 300,000 homes. This farm would utilize the transmission infrastructure currently connecting the coal-fired Colstrip Power Plant to the Pacific Northwest and create new jobs in the area (Lutey 2016). Carbon capture technologies are also being researched as a potential option to keep the Colstrip plant running while reducing carbon emissions. With the future of this community at stake and so many different factors at play, there is a desperate need for all of this to be communicated in an effective way.

3. Developing the Website

After deciding to develop a website communicating information about coal and the situation in Colstrip, I started looking at other environmental websites and comparing design choices and methods. I also started reviewing different platforms for building websites to determine which one would work best for me. I researched the principles of web design and usability as I began to develop a layout and make style choices for the site.

There were several environmental themed websites that I reviewed to compare design choices. EPA's website ([www.epa.gov)](www.epa.gov) had some great photos and videos, but the navigation menu was unclear and information seemed scattered. Greenpeace ([www.greaenpeace.org)](www.greaenpeace.org) was a great example of a grassroots site focusing on the use of media. It provided visually interesting material, but the layout lacked organization and required a lot of scrolling on every page. I also visited the World Coal Association ([www.worldcoal.org)](www.worldcoal.org) site, which had very informative content but was flooded with text and had drop down menus that were difficult to use. Studying these different sites was helpful in developing my website, I took note of the design choices that worked and applied those to my site while avoiding the features that did not work well.

The software used throughout the development of the site included Adobe Premiere Pro CC 2017 and Adobe Photoshop CC 2017. These applications were used to create videos and images for the website. After researching the different elements, I began to construct the website and bring everything together.

3.1. Choosing a Platform

There are multiple options available when it comes to picking a platform to build a website on. Some of the most popular platforms are Wordpress, Weebly, Wix, and Squarespace. I compared the details of each different platform and read reviews before deciding which one to

use. After testing out both Wix and Wordpress, I decided to use Wix for this website since it provided me with all of the features I needed for this project. Wix is one of the most user-friendly website builders available; it offers flexibility, a wide array of design options, and useful apps and extensions. My website includes videos and images and the Wix platform included apps to assist me with uploading this media and customizing the way it is displayed. I was able to create a website specific to my needs and integrate interactive features without difficulty.

3.2.   Design Choices and Usability

As I began to develop the website's style and layout, I joined the research I had done on rhetoric and semiotics with the principles of web design and web usability. I studied the top web design principles that I believed would make the website aesthetically pleasing, easy to use, engaging, and effective. These principles include purpose, communication, typefaces, colors, images, navigation, and layout (Shortie Designs 2017).

I became familiar with these principles and focused my design choices based on the general description of each one. Purpose and communication for the website were determined prior to starting the design process, I wanted to have a clear understanding of the sites objective and how the information would be organized before I started building the template. I created a simple navigation menu and used a grid based layout to arrange the content, then followed that step with choosing fonts, colors, images and videos that followed the design principle recommendations. I also researched the elements of web usability and paid close attention to those elements as I developed the website. After the site was completed, I conducted usability testing to determine how easy it was to use. Understanding design and usability were extremely important factors in creating an appealing and effective website.

3.2.1. Design Choices

3.2.1.1. Purpose

Before designing the website, it was important to determine the specific needs of the users. Each page of the website needed to have a clear purpose, and to fulfill a specific need for the user in the most efficient way possible. I gave each page a clear title that explained the information communicated on that page. I also included a subtitle that provided a brief overview of what information would be found on that page.

3.2.1.2. Communication

After establishing the site's purpose, I needed to find the ideal way to express it to the audience. People on the web want information quickly; it is important to communicate clearly and make the material easy to read and digest. I chose to organize the content into individual sections making it easier to find specific information. I also used bullet points to break up the text and shortened the sentences so they got to the point quickly. I added appropriate videos, images, and infographics to accompany the written content for each section.

3.2.1.3. Typefaces

As I began to add text to the website I tested out different fonts, looking for the most clear and simple fonts available. It was important to keep typography practical and readable when designing the website. In general, studies have shown that San Serif fonts like Aerial with a font size between 14-16 pixels are easier to read online (Bernard and Mills 2000). A maximum of three typefaces and three pixel sizes is recommended to help keep the design streamlined. I chose to use the DIN Neuzeit Grotesk font set at 60 pixels for the page titles to help them stand out. This is a font with German roots that is simple, yet bold. For the body of each section I chose Open Sans set at 30 pixels for section titles and Open Sans set at 15 pixels for section

paragraphs. This font has a neutral appearance and is optimized for web and mobile interfaces. These are both San Serif fonts that make the content easy to read.

3.2.1.4.   Colors

Choosing a color scheme was just as imperative as deciding on fonts for my website. A well thought out color palette can go a long way to enhance the user experience. Complementary colors create balance and harmony. Using contrasting colors for the text and background will make reading easier on the eye. Vibrant colors create emotion and should be used sparingly (Shortie Designs 2017). I chose a color scheme that represented the coal industry, using different shades of black and grey for backgrounds and titles. I used a white color for the paragraph text and used a grey background to create contrast and make the content easy to read.

3.2.1.5.   Images

A picture can speak a thousand words, and choosing the right images for the website was key in attracting users and creating interest. I used a few original photographs I had taken as well as photos I collected from other sources to use in the page headers, backgrounds, and within each section. This made each page more visually appealing and provided useful visual aids to go with the written content. Also, using infographics, videos and graphics can be much more effective at communicating than even the most well written piece of text (Shortie Designs 2017). Since the topic I was communicating on this website was complex, I emphasized the use of these tools to help make the information more interesting and easier to understand for all audiences. I filmed interviews, edited footage, created infographics, and used existing video clips and infographics to help communicate the message.

3.2.1.6. Navigation

The goal of navigation for my website was to make it easy for people to move around the site and find what they were looking for. A navigation area should be as simple as possible, following the 'three click rule' which means users will be able to find the information they are looking for within three clicks. Given that a computer screen is traditionally used in a landscape format, horizontal navigation is the most popular option, it feels more balanced, less intrusive, and easy to place from a design perspective (Gittings 2017). I chose a very simple navigation system, separating the website into six main sections with clear titles (Timeline, Mining, Power, Future, Community, Resources) and no drop-down menus. I created large buttons for each menu item and chose horizontal navigation, placing the menu in the upper right section of the website. The menu appears on every page and makes it easy for the user to move throughout the site with minimal clicking.

3.2.1.7. Layout

Since my website had an abundance of content, I wanted to develop a structured layout that organized the content accordingly. Placing content randomly on the website can give the site a chaotic appearance and make it difficult to interpret the information. Grid based layouts arrange content into sections, columns and boxes that line up and feel balanced, which make for a visually appealing website. I chose to use the slideshow feature in Wix on every page, this helped separate the content into sections and allows for the user to scroll horizontally instead of vertically to view each slide. The slideshow feature also adds motion to the website and creates a more interactive experience for the user. Within each slide, I chose to place the images and videos to the left and the written content to the right. Western cultures read left to right, however,

the images will most likely draw the users attention immediately. The user will be looking at the image first and then scan to the right of the image to view the text.

3.2.2. Usability

One of my primary objectives for this project was to create a website that anyone would feel comfortable using. After making design choices and adding content to my website, I wanted to be certain that the site was easy to use. For websites, usability is a necessary condition for survival. If a website is difficult to use, people will leave. If the site doesn't clearly state its purpose or people get lost trying to find the information they seek, they will leave the site and look for something else. If web pages are going to be effective, they have to be self-evident, or at least self-explanatory so that a user will know what it is and how to use it just by looking at it (Krug 2006). A well-documented fact about web use is that people tend to scan webpages instead of reading them, looking for specific words or phrases that catch their eye. Depending on the purpose of the website, content needs to be very clear, concise and draw the user in quickly.

Usability is defined by five components (Nielsen 2003), these include:

1. Learnability: This component looks at how easy it is for a user to accomplish basic tasks the first time they use the website.

2. Efficiency: This component analyzes the user's ability to quickly perform tasks once they are familiar with the website.

3. Memorability: This component determines how quickly a user can reestablish proficiency using the website after they have spent some time away from it.

4. Errors: This component tracks how many errors a user makes, how serious the errors are, and how easily they recover from the errors while using the website.

5. Satisfaction: This component studies how enjoyable the user's experience is using the website.

I paid close attention to these five components when I conducted usability testing for my website. I chose three random people who have no experience testing websites to perform a list of tasks that someone is likely to perform who is using the website for the first time. I observed each person as they performed the tasks and took thorough notes. By using this method, I could immediately see if the users were able to complete each task and if they had any difficulties along the way. I used the results to fine-tune the website and fix any issues that the users made me aware of.

3.3. Software Used

Adobe Premiere Pro and Adobe Photoshop were the two primary software applications that I used throughout the development of my website. These applications were both extremely beneficial since my goal was to incorporate a great deal of videos and images into the website. Adobe Premiere Pro is a video-editing software that allows users to compile, edit, and add effects to their video footage before exporting it into a variety of video formats. I used Premiere Pro to edit the footage I had taken and create short videos for the website. I also used Premiere Pro to revise some of video clips that I had found online. Adobe Photoshop is a popular photo editing software gives users access to a wide range of editing tools plus the ability to create original digital drawings. Photoshop was useful in creating several infographics and images for the website, as well as editing the photos I had taken and gathered from other sources. The videos and images that I created or edited using these software applications were a significant contribution to the overall website. The effective web design choices, usability testing, and media created all played a crucial role in the development of this website.

4. The Colstrip Coal Website

The purpose of the website I developed is to inform the public about the coal-fired power plants and the community of Colstrip, Montana. The site also communicates valuable information about the history of coal in Montana, coal mining, power generation from coal, coal in the economy, carbon capture, and enhanced oil recovery. The site serves as an educational tool that provides a comprehensive overview of coal with a focus on Colstrip. I concentrated on using photos, infographics, animations and videos to engage the users and create a more interactive experience. The website consists of seven different pages; Home, Timeline, Mining, Power, Future, Community, and Resources. Each page has the same layout and design, but uses specific images and videos relevant to the page's content.

4.1. The Home Page

The home page is the initial page a user will see when visiting the website; it is meant to attract visitors, communicate the primary purpose for the site and facilitate navigation to other pages on the site. I chose to use a video as the background for this page; it has no sound but displays interesting footage related to Colstrip and the power plant. I included the main navigation menu at the top, but also added photos to the homepage that represent each section and link to those pages. This will help users understand what type of content they can find on each page. Below the photos, I added a news section with photos and brief summaries of current news related to the coal industry and Colstrip. Each news item links to the full article, which will open in a new page.

4.2. The Timeline Page

The page titled "Timeline" is the initial link in the menu; I chose it to be first because this page provides a brief overview of the history of coal in Montana. I used an open-source tool

developed with the programming language called JavaScript to build a visually rich, interactive timeline that the user can scroll through easily (https://timeline.knightlab.com/). The timeline displays a list of important events that occurred, from the discovery of coal in Montana to the current situation in Colstrip. The events are in chronological order, displaying the year of each event. There is an image included with each event along with a brief summary of what occurred.

4.3. The Mining Page

The mining page is the second link in the navigation menu, meant to give the user an opportunity to explore the basics of coal and coal mining. The first section on this page discusses facts about coal, where coal is found, and how it is mined. The intent of this section is to give the user a fundamental understanding of coal as a natural resource. The second section goes into more detail about coal mining in Colstrip, Montana. It provides an overview of Colstrip mining history, important information about the Rosebud Mine and discusses mining reclamation and how it is implemented in Colstrip. Both sections have photos, infographics, and videos that complement the written content. I used photos that might evoke a negative reaction by some visitors, but they realistically represent coal and could reshape how the user views coal after reading the information attached to the images. This page will help the user comprehend the significance of coal mining and how it plays a major part in coal as a resource.

4.4. The Power Page

The next page leads the user into information about turning coal into electricity; it is titled "Power". The first section on this page discusses how electricity is created from coal, and addresses electricity transmission and the electric grid, and the environmental impacts of using coal-fired power plants. I used animations to help explain power plants and the transmission grid, these were useful tools to simplify complex and detailed technical information. There are also

educational videos and infographics included in the content. The next section follows suite by reviewing the Colstrip Power Plant. It contains photos and historical facts about the plant, current data about the plant, a diagram explaining how the plant generates electricity, photographs from inside the plant, and an overview of the environmental impacts associated with the plant. This section also lists the six generating plant owners and what percentage each one owns, as well as how the electricity from the plant is transmitted to the grid. Once again, I did not shy away from using photos of power plants that could be considered "dirty", with images of steam rising from the plant stacks and the ash ponds nearby. The intent was to accurately depict a coal-fired power plant, and after the user becomes familiar with the information attached to the images, they can develop a more educated outlook on coal-fired power plants. The purpose of this page is to help the user understand how the Colstrip plant works and how important it is to the generation of electricity in this region.

4.5. The Future Page

The mining and power pages educate the user on what coal is and how it is used, and cover a lot of technical information. The future page discusses the current events surrounding coal and how it is impacting Colstrip. The first section on this page describes what has happened to coal in this country over the last decade, the pending closure of the Colstrip plant and the reasons for the closure, and the economic impacts of the closure. The second section talks about the continued need for coal as an energy source and how we can still utilize this resource while minimizing impacts to the environment. It explains carbon capture technology and the potential for using this technology in Colstrip.

This page includes video clips from news sources discussing the current events regarding coal and Colstrip, educational clips about carbon capture, and an interview with a Montana Tech

professor discussing the potential for carbon dioxide capture and utilization in Montana. The photographs I chose to incorporate into the layout for this page are rhetorical by nature, attempting to represent coal in a positive and colorful manner. One of the photos has a green plant growing out of a pile of coal, another is a photo of a power plant with a field of sunflowers in front of it. My goal was to encourage users visiting the site to consider looking at coal in a different light. While noting the environmental impacts of coal and the concerns about climate change, they can learn more about the potential for cleaner coal through technologies being researched and developed.

4.6.   The Community Page

It was necessary to include a human-interest section to this website to bring it full circle and help connect with the audience. The community page contains interesting facts about the history of Colstrip, city data, the benefits of living in Colstrip, the community's concerns about the plant closure, and how they are preparing for the future. I used photographs of the town and the people living there, as well as video clips interviewing community members. There was a wealth of videos with a human-interest theme available so I added a video gallery that allows users to browse and watch the clips that interest them. This page provides a perspective of coal through the eyes of the community members directly affected by it. This is a crucial part of the bigger picture and the audience needs to understand the significant impacts coal's future has on the communities that produce it.

4.7.   The Resources Page

The final page on the website is a portal to other important resources about coal. It includes each source's logo and a brief description. Users can click on the logo to open a link to that website in a new window. This gives people the opportunity to get involved or learn more

about specific information on coal, environmental regulations, carbon capture technology, and Colstrip.

      The seven pages included in this website provide a comprehensive overview of every aspect of coal in Montana, and particularly in Colstrip. The website can act as an educational tool for industry leaders, politicians, Montana residents, and anyone looking for information on the topic of coal. After visiting the site, users will have a better understanding of this complex and controversial subject.

5. Problems Encountered

Choosing a complicated and dynamic research topic meant I was going to face some difficult challenges along the way. I was challenged by time constraints, fluctuating information, a lack of resources, and technical limitations. Creating a large website that encompasses all significant aspects of coal is not practical within the limited timeframe allotted to a master's degree program. I had to focus on limiting the content to the most relevant and important information on coal and Colstrip. Coal is a very controversial subject and the current situation with Colstrip is constantly shifting and evolving. It was challenging to stay on task with the information I was trying to communicate because of the continual changes driven by politics and economics. Differentiating between what was factual and what was opinion based was another challenge when compiling content for the website. There is a plethora of activism surrounding this topic and I was trying to remain objective and avoid including information that wasn't verifiable. I also intended to conduct interviews and gather content from some of the major players involved in coal: unfortunately, I was unable to make contact with most of them. I reached out to these sources through phone and email several times but they were not responsive. Additionally, there were some technical limitations that I encountered without resolution. I built a website with an abundance of videos, animations, and high-quality images. This slowed the site down and caused it to run sluggishly at times. Additionally, due to the media content, the website is not very mobile friendly. These issues did not prevent the completion of the project and can be addressed in the future with additional time and resources.

6. Recommendations

There is great potential for growth of the Colstrip Coal website. Now that the layout has been developed and the key material has been added to the site, it can be updated regularly with new and relevant information. The site can also transform and take new shape based on future needs. With additional time, new resources can be found and new videos and images can be created. There is an abundance of information out there and some of the topics on the website like carbon capture and environmental impacts would benefit from being updated and expanded in the future. The technical aspects can also continue to be improved upon as options and upgrades become available. The Colstrip Coal website can serve as a valuable tool in communicating technical information and educating the public about coal as an important natural resource to our state and region.

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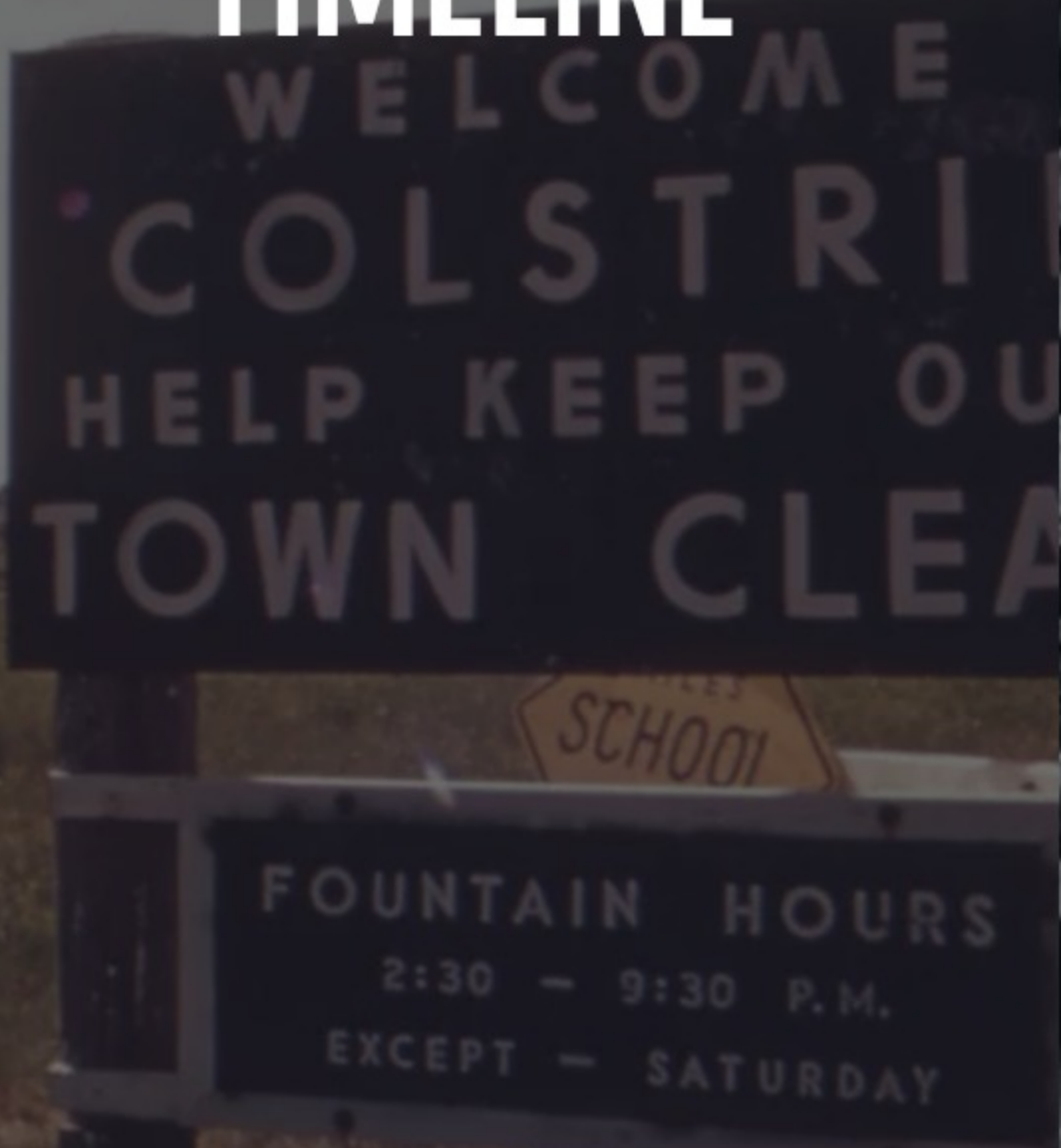
8. Appendix A: Colstrip Coal Website Pages ([www.colstripcoal.com)](www.colstripcoal.com)

THE COAL STORY

A WEBSITE DEDICATED TO COMMUNICATING THE FACTS ABOUT
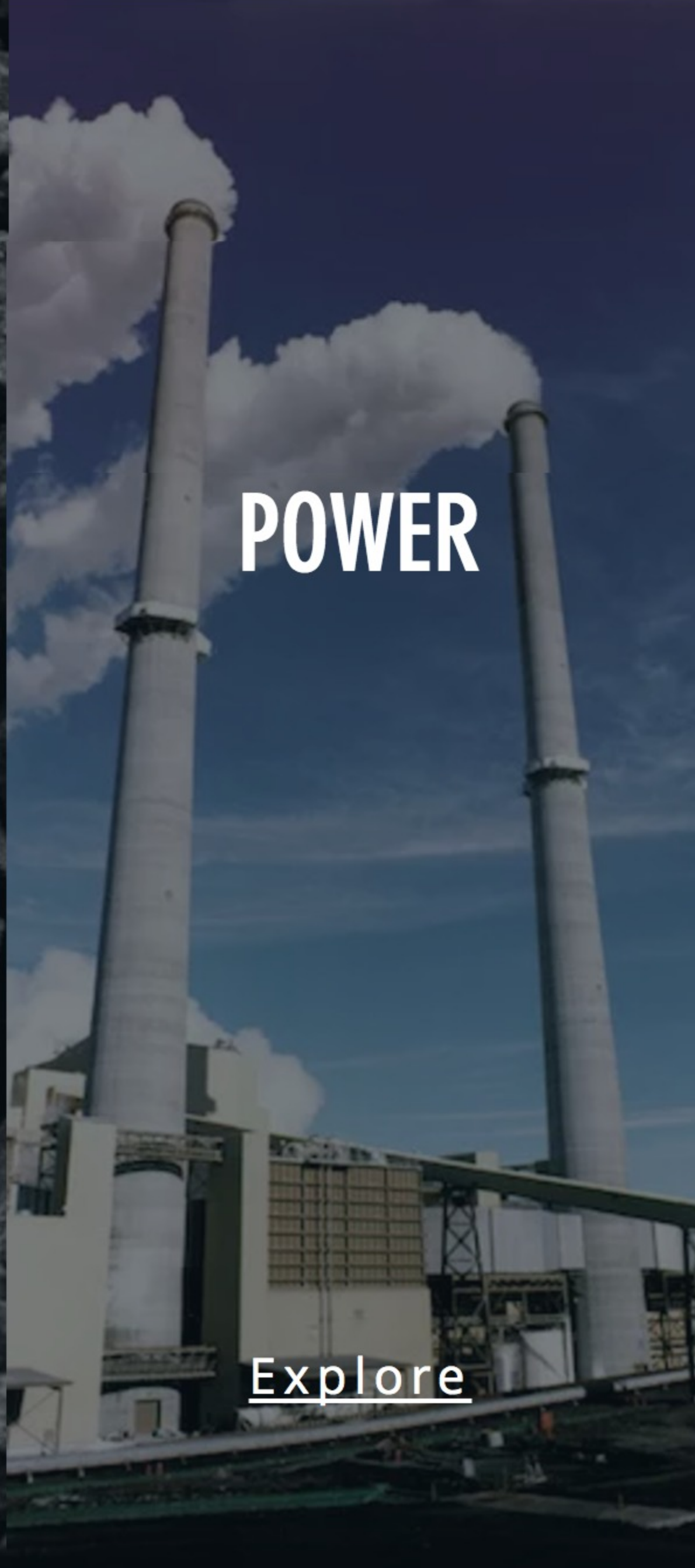MONTANA'S COAL AND WHAT THE FUTURE MAY HOLD...

PBS

TIMELINE
Explore

MINING
Explore

POWER
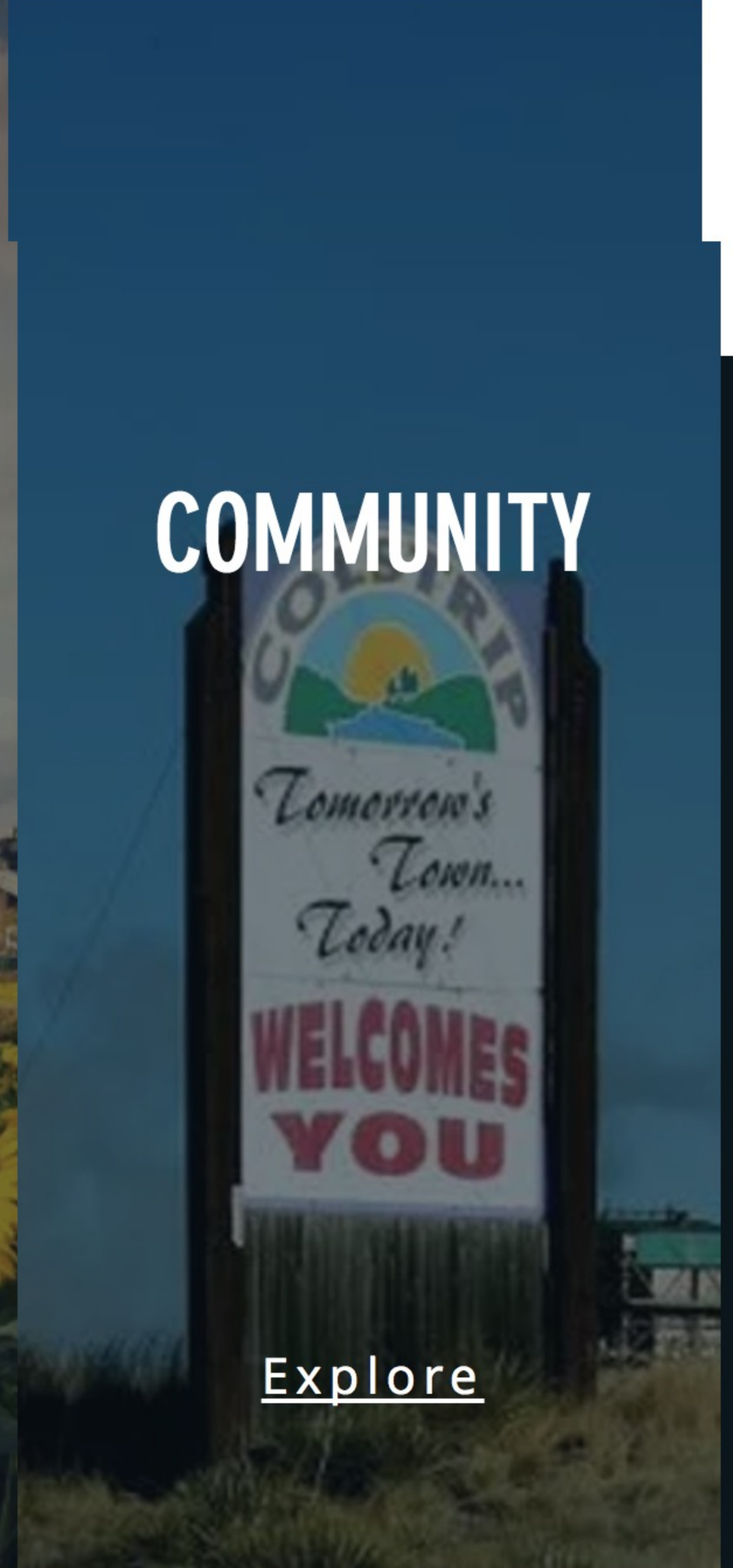Explore

FUTURE
Explore

COMMUNITY
Explore

What's in the news?

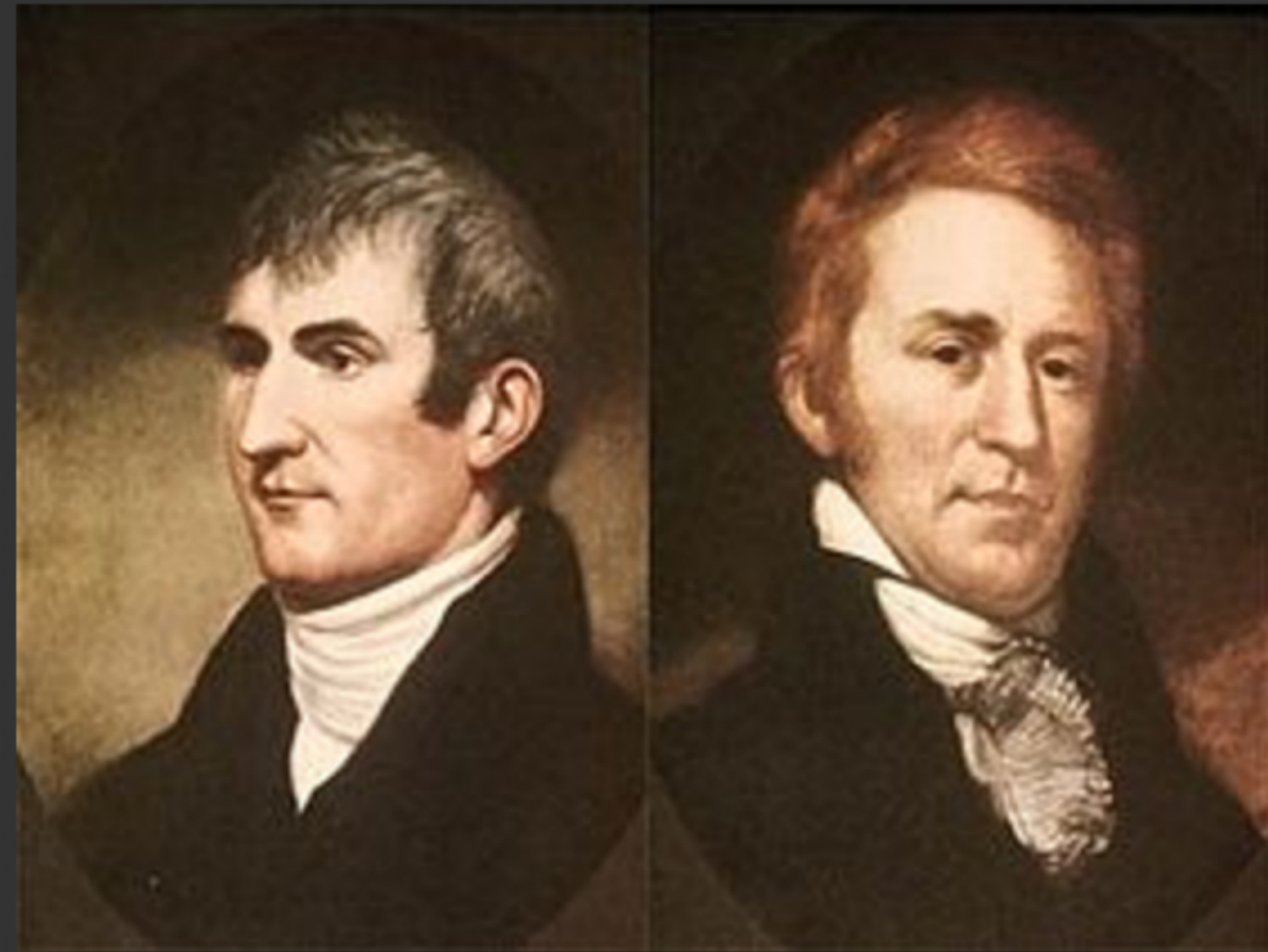**Puget Sound Energy unveils long term economic plan for Colstrip**
April 12, 2017
The majority owner of the Colstrip Power Plants in eastern Montana unveiled its long term economic plan for the Colstrip community.

◄ 1 / 13 ►

Search Site

TIMELINE

A trip through the history of

coal in Montana

Wikimedia

1806

DISCOVERY

Coal was initially discovered in Montana by the Lewis and Clark Expedition explorers.
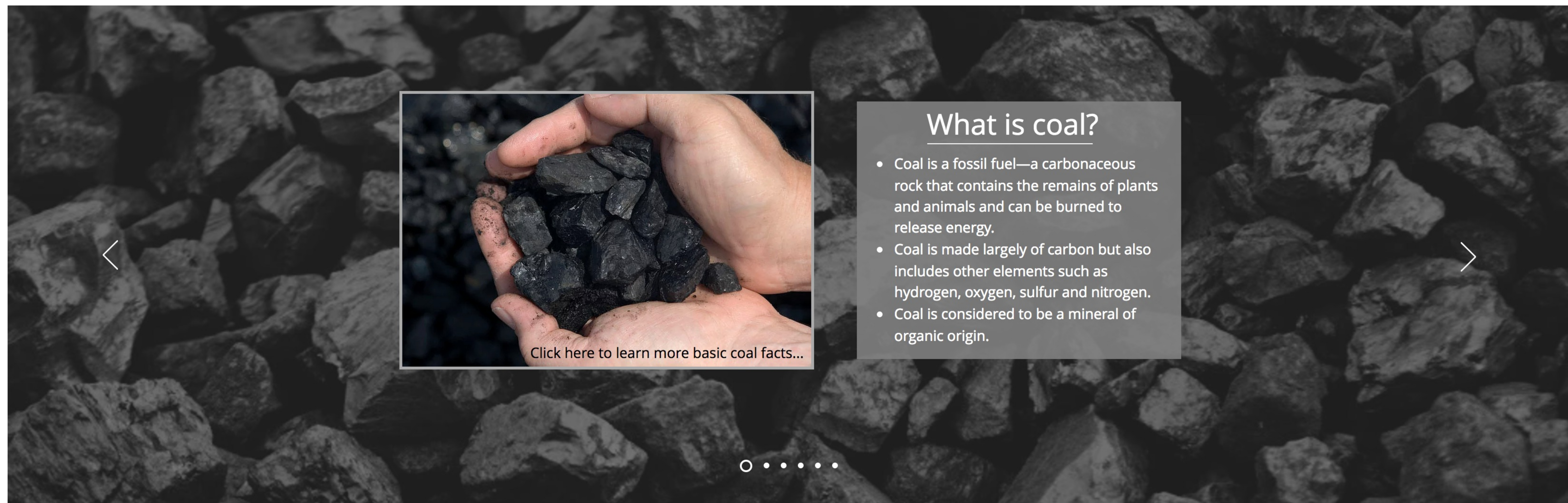
❯

MINING BEGINS

🔍+
🔍−
↩

Mining
Begins

1823 1826 1829 1833 1836 1839 1843 1846 1849 1853 1856 1859 1863 1866 1869 1873 1876 1879 1883 1886 1889 1893 1896 18
◆ Timeline JS
1830   **1840**   **1850**   **1860**   **1870**   **1880**   **1890**
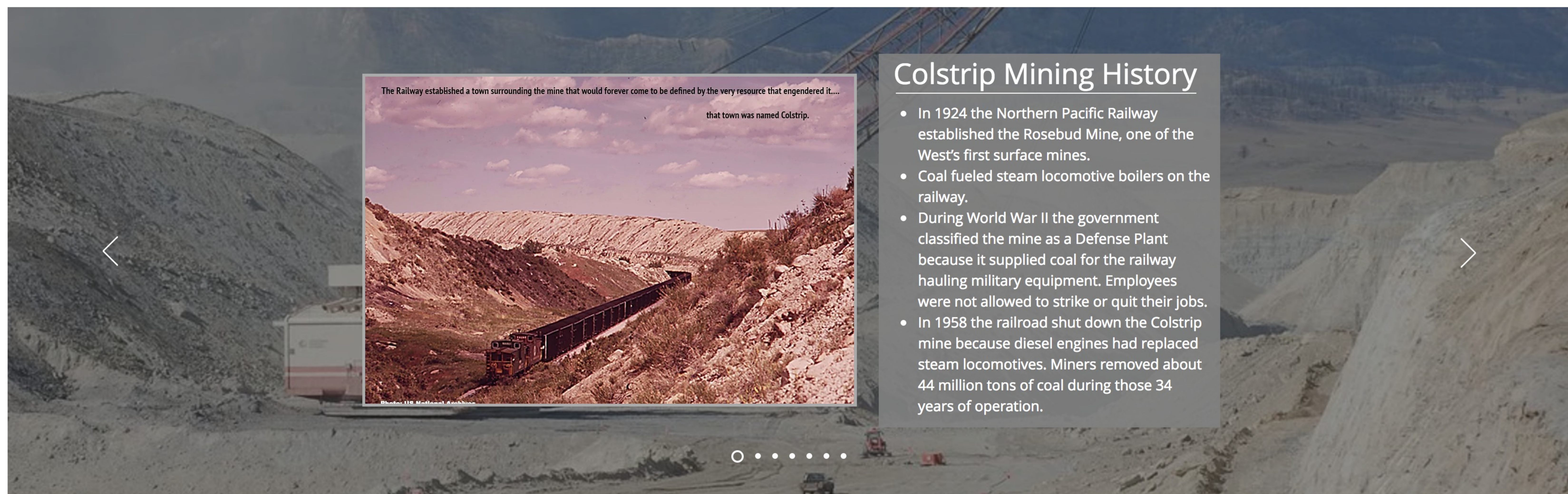
🔍 Search Site

MINING

Information on coal, mining, and the
Rosebud Mine in Colstrip, Montana

Photo: Beth Saboe

What is coal?

- Coal is a fossil fuel—a carbonaceous rock that contains the remains of plants and animals and can be burned to release energy.
- Coal is made largely of carbon but also includes other elements such as hydrogen, oxygen, sulfur and nitrogen.
- Coal is considered to be a mineral of organic origin.

Click here to learn more basic coal facts...

Colstrip Mining History

The Railway established a town surrounding the mine that would forever come to be defined by the very resource that engendered it....

that town was named Colstrip.

Photo: US National Archives

- In 1924 the Northern Pacific Railway established the Rosebud Mine, one of the West's first surface mines.
- Coal fueled steam locomotive boilers on the railway.
- During World War II the government classified the mine as a Defense Plant because it supplied coal for the railway hauling military equipment. Employees were not allowed to strike or quit their jobs.
- In 1958 the railroad shut down the Colstrip mine because diesel engines had replaced steam locomotives. Miners removed about 44 million tons of coal during those 34 years of operation.

Search Site

POWER

Information about coal-fired power plants and the plant in Colstrip, MT

History of Coal Use

- Throughout history coal has been used for heating, cooking, and creating value added products.
- During the industrial revolution, coal was first used to fuel steam engines.
- By 1875, coal in the form of coke replaced charcoal as the primary fuel used to make steel.
- In the 1880s, coal was first used to generate electricity.

1850

Colstrip Plant History

- In the 1960s, Bonneville Power Administration predicted that hydropower would soon become unavailable and the Northwest's utility companies should start seeking alternative power supplies.
- In 1971, Montana Power Company and Puget Sound Energy joined forces to build Units 1 and 2 of the Colstrip coal-fired power plant.
- In 1975, construction was complete and Units 1 and 2 began operations.
- A few years later, the construction of Units 3 and 4 began, during that time the population of Colstrip grew to 8,000.
- In 1985, Units 3 and 4 began operations and the Colstrip Generating Station became the largest man-made structure in Montana and the second-largest energy producer in the West.
- In 1997, the Montana Legislature deregulated Montana's power business with the expectation that competition would drive down energy prices. This made Montana Power a nonregulated entity.
- In 1998, Montana Power sold its share of the 4 units to Pennsylvania Power and Light (PPL) along with their hydro facilities (later spinning off as Talen Energy).
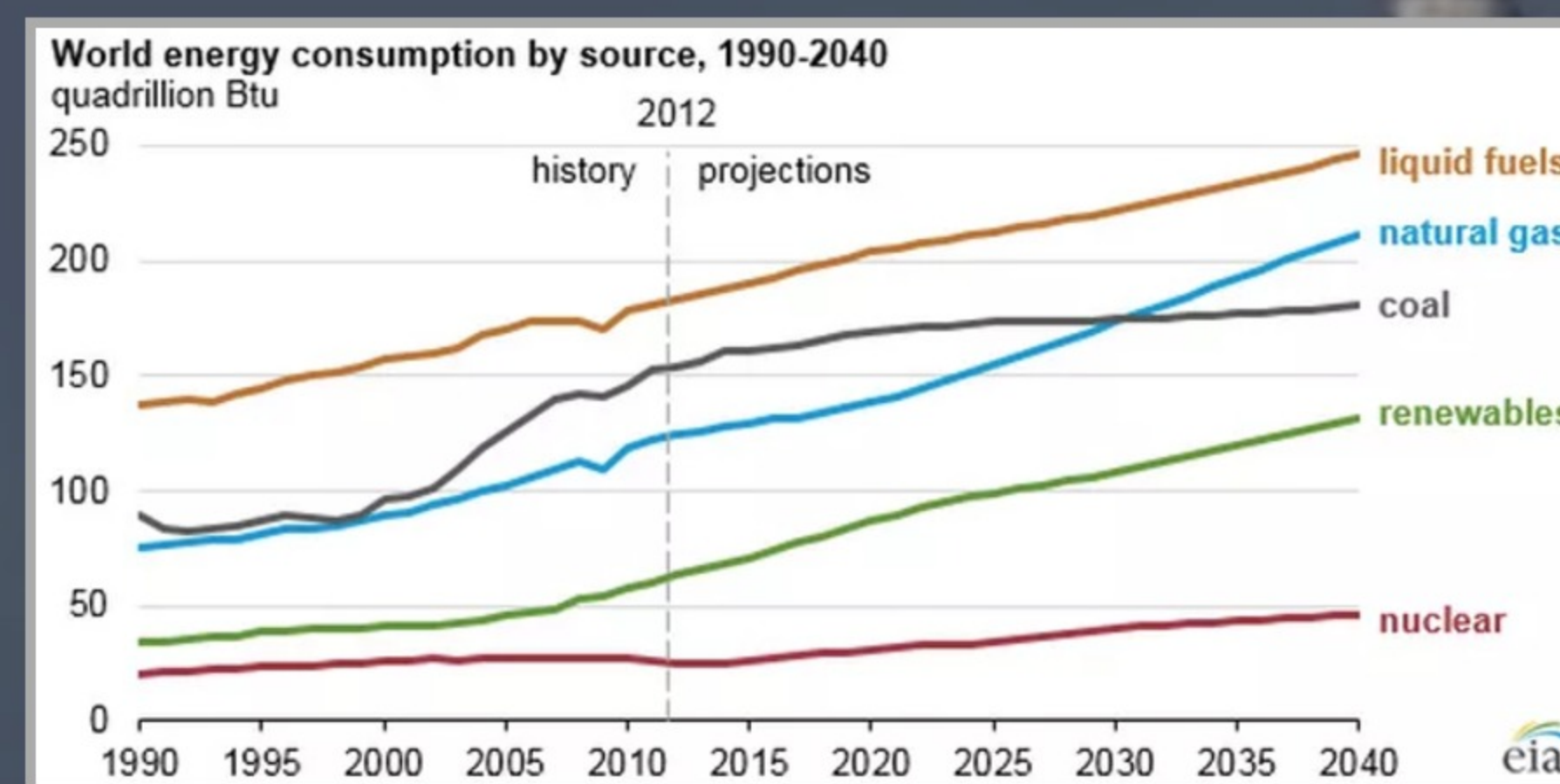
Search Site

FUTURE

What does the future hold for Colstrip's coal?

What happened to coal?

○ ● ● ● ●

World energy consumption by source, 1990-2040
quadrillion Btu
2012

250 ┆ history │ projections ── liquid fuels
200 ┆ ── natural gas
150 ┆ ── coal
100 ┆ ── renewables
50 ┆ ── nuclear
0 ┆
1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040
eia

"We cannot wish coal out of the energy mix."

Benjamin Sporton, Chief Executive
World Coal Association

and we need all low emission technologies to reduce emissions.

What's Next?

- According to the DOE, there will be 48% increase in world energy consumption by 2040, with energy from coal still needed for the foreseeable future.
- If and when the price of natural gas starts to increase, the demand for coal will likely rebound.
- Clean coal technologies are being developed to reduce carbon dioxide emissions while continuing to utilize coal, these include:
  - Gasification
  - High efficiency low emission coal (HELE)
  - Carbon capture and storage (CCS)
- Carbon capture is an increasingly popular technology that could help sustain the use of coal and the viability of Colstrip.
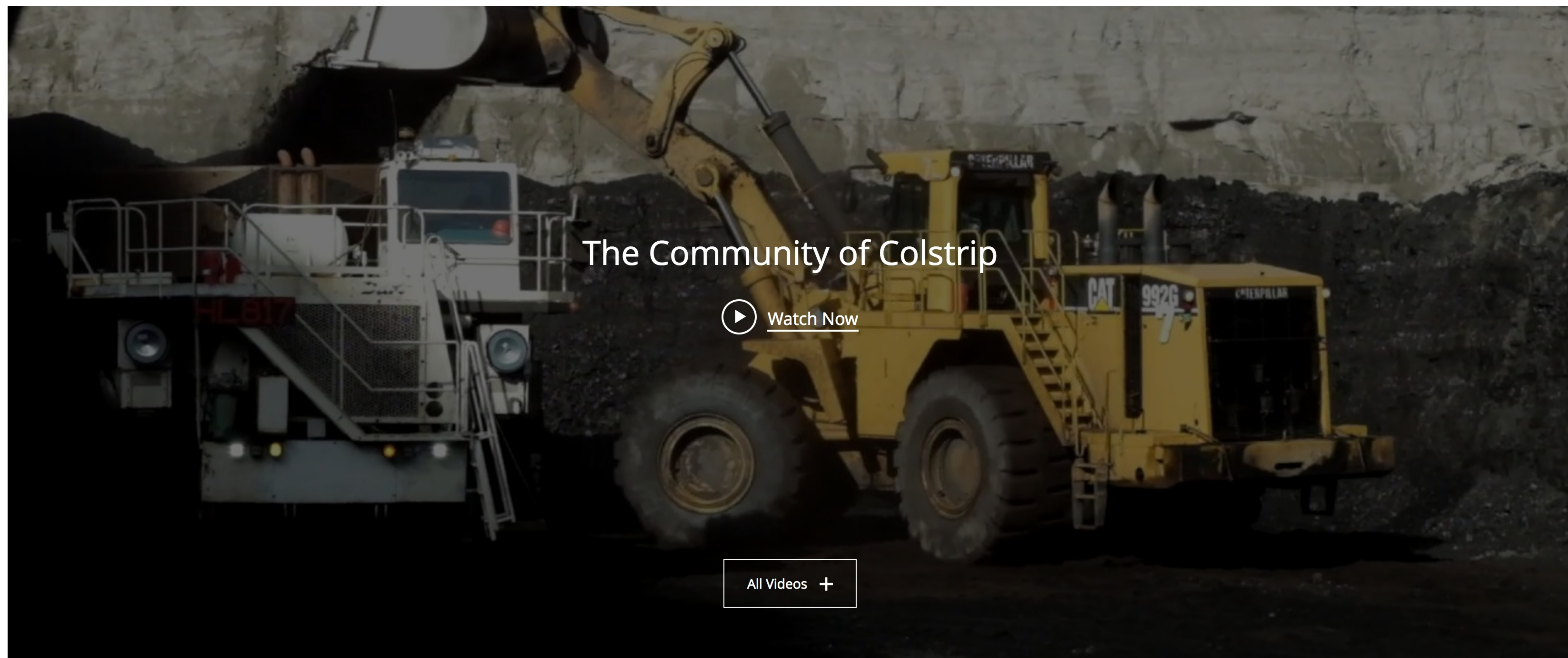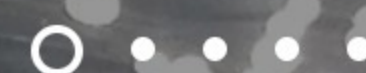
○ ● ● ● ● ●

🔍 Search Site

COMMUNITY

All about Colstrip, Montana and the
threats this town is facing
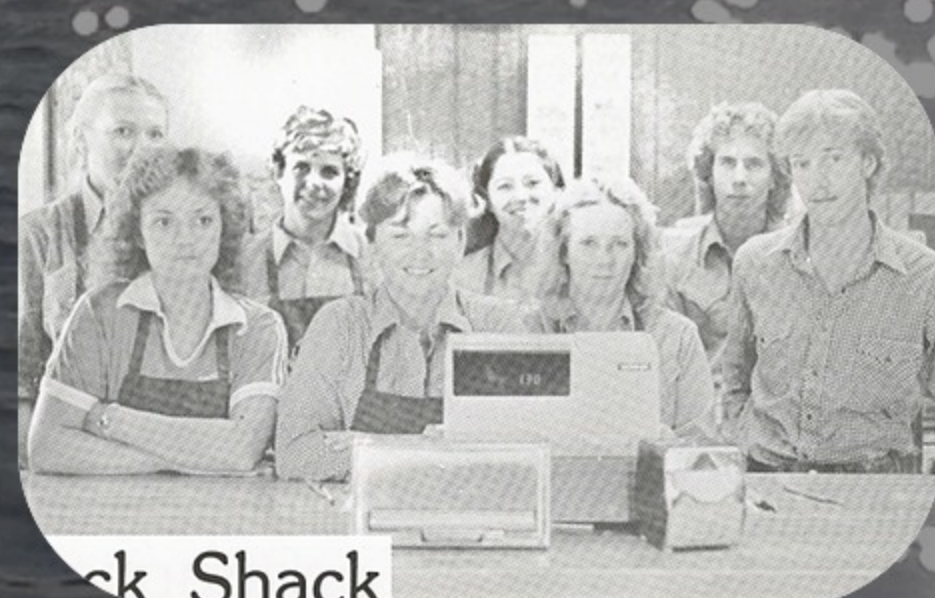
Colstrip's History

- Colstrip began in 1924 as a mining town providing coal to the Northern Pacific Railway.
- The town was purchased by Montana Power in 1959, who with a group of partners built a large coal-fired electric power plant in the 1970s and 1980s. Colstrip was considered a boom town during those decades, with the population growing to 8,000.
- The coal severance tax money helped the community develop into more than just a coal mine and power plant. Amenities like parks, hiking and biking paths, a golf course and a recreation center/swimming pool helped Colstrip become a family town.
- The City of Colstrip incorporated in 1998.

ck Shack

The Community of Colstrip

▶ Watch Now

All Videos ✛

🔍 Search Site

This website is a collaboration of information from multiple sources. If you have any questions or would like to contribute to the site, please contact me.

RESOURCES

Visit these sites to learn more about coal, coal-fired power plants, and Colstrip, Montana

WORLD COAL ASSOCIATION

The global network for the coal industry where you'll find information about coal, the environment, sustainable development, coal industry news, global coal facts and more...

eia

The U.S. Energy Information Administration is the official Energy Statistics from the U.S. Government.

U.S. DEPARTMENT OF ENERGY

The Energy Department is working to develop technologies that make coal cleaner, so we can ensure it plays a part in our clean energy future.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

An agency of the Federal government of the U.S. that writes and enforces environmental regulations with the purpose of protecting human health and the environment

AMERICAN COAL FOUNDATION

Develops, produces and disseminates coal-related educational materials and programs designed for teachers and students

CLEAN COAL. AMERICASPOWER.ORG

A group that promotes improved technology research for the coal-based power plant industry to reduce its emissions.

**EERC** Energy & Environmental Research Center® Putting Research into Practice

A research, development, demonstration, and commercialization facility for energy and environment technologies development.

Western Education Foundation for Resources

This foundation seeks to enhance public awareness of the economic and social importance of the natural resource industries.

WESTMORELAND COAL COMPANY

The company that owns and operates the Rosebud Mine in Colstrip, Montana
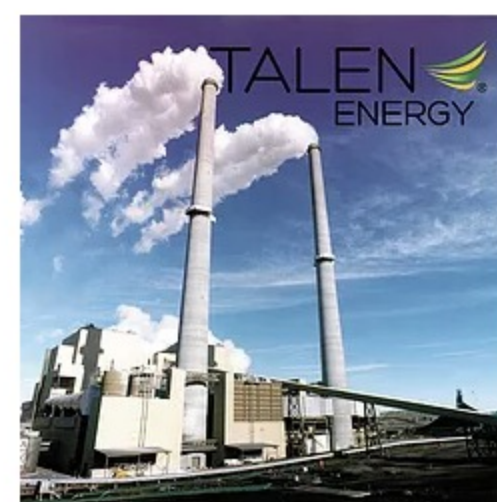
TALEN ENERGY

An independent power producer that owns part of the Colstrip Power Plant and also operates the plant

COLSTRIP UNITED RESPONSIBLY SUPPLYING RELIABLE POWER

A grassroots movement dedicated to educating the public about the importance of coal and coal energy for the state of Montana

WELCOME TO COLSTRIP

The City of Colstrip Official Website

🔍 Search Site